Guidance on Creating a Local Area Energy Plan

CATAPULT Energy Systems

UK Research and Innovation

LOCAL AREA ENERGY PLANNING

Contents

Introduction

There is a growing consensus, locally, nationally, and internationally, that the threats posed by climate change should now be treated as an emergency. In 2019, the UK government amended the Climate Change Act (2008), that previously legislated for a reduction in greenhouse gas emissions of 80% by 2050 compared to 1990 levels, to be net zero. The change is significant - no longer can anything be considered 'too difficult' to tackle – every source of emissions must be accounted for and addressed. In 2021, the UK government published its plans to meet net zero[1] and for decarbonising heat in buildings[2].

1 https://www.gov.uk/government/publications/net-zero-strategy
2 https://www.gov.uk/government/publications/heat-and-buildings-strategy.

Whilst net zero policy is at the national level, delivering net zero will require action at the local level. 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 on local area energy planning (LAEP).

Through previous research undertaken by Energy Systems Catapult (ESC)[3], interviews with the sector identified the benefits of creating a Local Area Energy Plan; interviewees identified several benefits, including that a LAEP provides a practical roadmap as to how a net zero energy system can be achieved in a local area. Interviewees recognised that net zero ambitions have sometimes seemingly been set without a full understanding of whether and how they can be achieved, and LAEP helps to overcome that by setting out what actions need to be taken, by who, where, when, and how much it will cost

What is Local Area Energy Planning (LAEP)?

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 most cost-effective preferred pathway and sequenced plan of proposed actions to achieving an area's net zero goal.

The scope of the LAEP covers the current energy consumption and associated greenhouse gas emissions 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) and some aspects of energy used for transportation. The Ofgem Method[4] for LAEP summarises this by stating that it 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 provides a level of detail comparable to an urban masterplan. It provides a proposed future plan 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 the development of a district heat network by assessing the types of buildings in the zone, their characteristics, and density, and existing network infrastructure; however, to deliver the district heat network it would require a full feasibility assessment by an appropriately qualified installation/design company, along with assessment of commercial viability and delivery mechanisms.

3 https://es.catapult.org.uk/report/the-future-of-local-area-energy-planning-in-the-uk/

4 https://es.catapult.org.uk/report/local-area-energy-planning-the-method/

LAEP definition

The definition of LAEP was developed in '*The future of local area energy planning in the UK*'[5]:

- 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 other 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.

5 https://es.catapult.org.uk/report/the-future-of-local-area-energy-planning-in-the-uk/

Why has this Guidance been developed?

This Guidance has been developed to meet the need for a common approach to LAEP.

It has been identified[6] that LAEP guidance and templates are needed. Without them, local authorities and other stakeholders do not know what they are producing, how they should do it, and what they should include. Guidance, with accompanying suggested approaches 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.

In addition, several organisations have published reports recently that all highlight the importance of LAEP and adopting a place-based approach to meeting net zero[7] [8] [9] [10] [11].

What is the purpose of the Guidance?

This Guidance serves several purposes, including:

- A common approach allows for comparability between areas, and for multiple plans to be aggregated across a large area (i.e., a region).
- A common approach delivers efficiencies and value for money through familiarity for organisations involved in delivering several LAEPs, or for an organisation renewing a LAEP.
- A common approach identifies the characteristics of the underlying data and assumptions involved in creating a LAEP.
- To identify and provide clear guidance on the roles and responsibilities of those involved in creating a LAEP.
- To identify key characteristics of a minimum standard for creating a LAEP, that are consistent across multiple LAEPs.
- To provide confidence to those funding the implementation of the LAEP.
- To ensure that modelling tools meet the requirements to create a LAEP.

6 https://es.catapult.org.uk/report/the-future-of-local-area-energy-planning-in-the-uk/

7 https://gov.wales/planning-policy-wales

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

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

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

11 https://www.uk100.org/sites/default/files/publications/Net%20Zero%20Delivery%20Framework%20Executive%20Summary.pdf

How has the Guidance been developed?

The Guidance documented here has been developed by experts at Energy Systems Catapult (ESC), all of whom have been involved in developing and piloting the concept of LAEP in collaboration with government, local authorities, network operators, and businesses.

The initial activity was to identify all of the discrete tasks that typically were included in LAEP, and to categorise these. From this initial activity, a process of Stages was developed, with each Stage containing a number of steps, objectives, and discrete tasks.

The Guidance has also been developed in close collaboration with the sector[12]. Collaboration has been through a series of webinars held in February 2022, at which a subset of the Guidance (two Stages per webinar) was presented to attendees, and attendees asked for their feedback. Feedback was via email before or after the session, verbally during the session, or via the chat function during the session. Feedback took the form of answers to 3 to 5 specific questions per Stage, but also allowed for more general feedback and concerns to be raised. Four sessions were held, each lasting 90 minutes. The sessions were well attended; between 50-60 people attended each, with many attending all four sessions.

The Guidance builds on work previously undertaken by ESC and the Centre for Sustainable Energy (CSE) on behalf of Ofgem[13]. A method was developed that identified four critical elements of LAEP and set out quality criteria for each element, together defining what LAEP 'done well' involves. The Method develop0ed on behalf of Ofgem has been used to inform the development of this Guidance and is referenced and acknowledged accordingly throughout the guidance document.

Who is the Guidance for?

The Guidance is written for multiple audiences:

- Primarily, it is written for local government organisations who are anticipated will lead creating Local Area Energy Plans.
- Secondly, it is written for key stakeholders who have an active role contributing and supporting a local government organisation as it creates a LAEP. This includes network operators, advisors and consultants contracted to deliver aspects of a LAEP on behalf of a local authority.
- It is also written for other stakeholders who have a role in supporting a local authority as it creates a LAEP. This includes the general public and community groups, Local Enterprise Partnership (LEP), Net Zero Hub, academics, industry, social housing provides, investors and businesses in the locality where a LAEP is being developed.
- It is also written for other organisations who have an interest in net zero, including government departments (such as BEIS, DfT, DLUHC), devolved administrations, and national organisations (such as Ofgem, National Grid)

The roles and responsibilities of each organisation type is further detailed are further detailed at the end of this chapter.

12 See Annexe for a list of organisations who attended the sessions. This included local authorities, network operators, national and devolved government, national level organisations, and delivery consultants.

13 https://es.catapult.org.uk/report/local-area-energy-planning-the-method/

How do I use this Guidance?

The Stages of the Guidance are presented in sequential chapters, and it is advised that they are read and understood in the order they are presented. This applies particularly for a local authority who may be preparing to create a LAEP for their area, or for stakeholders who have been asked to contribute or support a local authority. Other audiences are also advised to read the Stages in the order they are presented if encountering the Guidance for the first time.

During the creation of a LAEP, it is anticipated that single chapters will be used heavily whilst each Stage is 'in-flight' and before moving to the next Stage. This is not to say that each Stage of the Guidance happens in isolation and is dependent upon the preceding Stage being complete; some Stages are delivered simultaneously (e.g., Stage 2 – Stakeholder Engagement – occurs throughout the process).

It should be noted that this document describes *guidance* on creating a LAEP. Whilst it is intended that it is used as presented, creation of the LAEP can be adapted to accommodate local needs and priorities, additional information or data and alternative approaches to energy planning. It is not intended to be prescriptive or to mandate a single course of action that every local area must strictly adhere to. Furthermore, it is not intended to replace or stop energy planning activity that is already underway, but to complement and enhance it; energy planning activity planned or already underway can be integrated into creating a LAEP.

Related supplementary documents

There are three documents that are annexes to the Guidance. These are:

- Annexe 1 - Template, Checklist, and Examples of Local Area Energy Planning
- Annexe 2 - Standard Data Inputs and Assumptions for Local Area Energy Planning
- Annexe 3 - Guidance for Socio-Economic Analysis in Local Area Energy Planning

Annexe 1 provides a template of a LAEP. The purpose of the annexe is to provide an example of what a finished LAEP may contain, and how it may be structured. It contains five main sections, with each section having sub-headings and suggested aspects to cover. It also shows what may be covered in the main body of a LAEP, and what may be covered in a supporting technical evidence base to a LAEP. To illustrate what a finished LAEP looks like, a number of examples have been included in the template from LAEPs that have recently been completed. Having LAEPs created in a consistent, standardised template allows between plans across regions and nations to be compared and consolidated, creating a picture of progress to net zero across larger geographical scales.

Annexe 2 provides guidance on the sources of national data that may be used in a LAEP, and any assumptions that are made when using these data. The document is broken down into a number of chapters, with each chapter describing a dataset. Examples from each dataset are shown, along with guidance on how to use the data, and highlighting any potential issues or considerations that may arise when using the data. The document also covers basic administrative details, such as where the dataset can be accessed from, how frequently it is updated, and who owns it.

Annexe 3 provides guidance on carrying out socio-economic analysis. Stage 5 requires assessment of both techno-economic and wider factors, and this Annexe provides guidance on factors to consider allowing potential benefits beyond decarbonisation to be identified. It draws heavily on guidance that is contained within HM Treasury's Green Book, but also identifies other sources of guidance. It describes both monetary and non-monetary benefits, and the methods that may be used to evaluate each type of benefit.

Introduction to the seven Stage process of creating a LAEP

The Guidance is presented as a seven Stage process, with each chapter in this Guidance describing a single stage. The seven stages are shown in Figure 1.

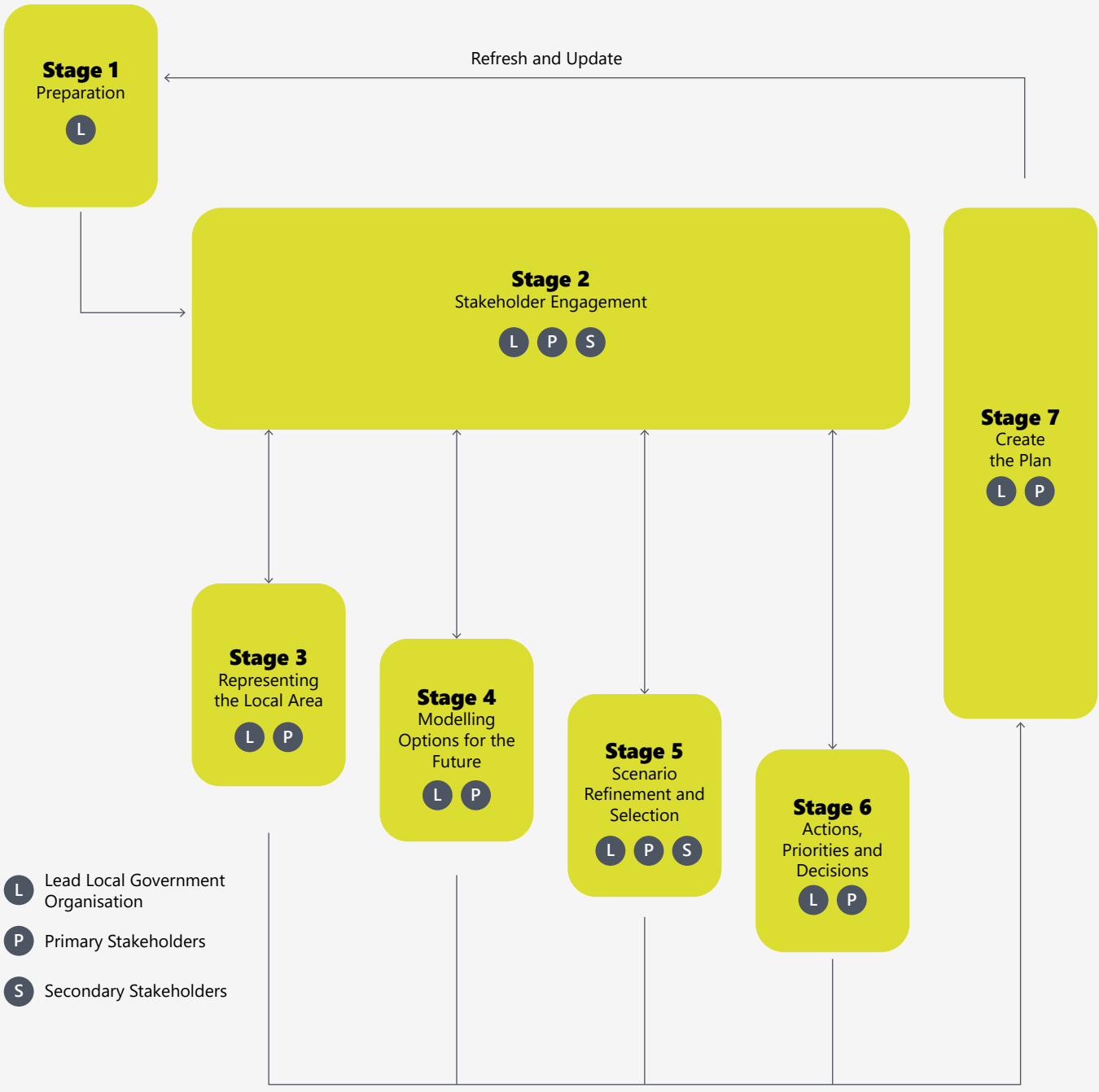

Figure 1: Seven Stages of local area energy planning

- Stage 1 describes the process of preparing to create a LAEP, identifying the geographical scale and appointing and mobilising the lead organisation, identifying roles and responsibilities, resources and scope and assessing policy drivers.
- Stage 2 describes the process of stakeholder engagement, appointing an organisation to lead the activity, mapping who stakeholders are and what role they will have in creating the LAEP, and defining engagement activities.
- Stage 3 describes the process of representing the local area and its energy system, identifying relevant data sources, analysing them, and reviewing outputs with stakeholders.
- Stage 4 describes the process of modelling the options to decarbonise the local area, agree potential scenarios and modelling approach with stakeholders, modelling a range of costed options, and assessing them.
- Stage 5 describes the process of refining scenarios and selecting pathways, with scenarios refined through techno-economic analysis, evaluation of wider factors, and engagement with stakeholders, leading to identifying of pathways to net zero.
- Stage 6 describes the process of assessing the pathways to uncertainty and identifying components as being near-term or long-term, and preparing for implementation.
- Stage 7 describes the process of creating the LAEP document

The process of creating a LAEP, from commencing Stage 1 to finishing Stage 7 is expected to take approximately 6-12 months. Updating an existing LAEP will require less time (approximately 3-9 months), depending upon the extent of the update and the length of time that has passed from the previous version.

Structure of each stage

Each Stage approximately follows this structure:

- Diagram showing relationship with preceding and subsequent Stages.
- Description of the purpose of the Stage.
- Each Stage is then broken down into several Steps, with each Step having objective(s).
- In some cases, the minimum requirements for delivering the Step are described.
- In some cases, details are provided for those who want to take their LAEP beyond minimum requirements ('Going Further')
- (If appropriate) Example of processes and approaches to consider.

Stakeholder roles and responsibilities

The purpose of this section is to describe the expected roles and responsibilities of stakeholders involved in creating a LAEP. It is described in this section to provide the necessary context in order for Stakeholders to understand what is expected of them before the Stages of the Guidance are described.

Primary stakeholders

Primary stakeholders are *responsible for creating* the LAEP. It is expected that the two types of stakeholders identified here *always* act as primary in every LAEP. They include:

- A single local government organisation who will own and have overall responsibility for leading creation of the LAEP and have executive decision-making powers.
- Network operators (electricity, gas, heat) who will play an active role in shaping the content and direction of the LAEP, contributing, and supporting the lead organisation in decision making.

Primary stakeholders are supported by secondary stakeholders in creating the LAEP.

Secondary stakeholders

Secondary stakeholders are *responsible for supporting* the lead local government organisation in creating the LAEP, contributing to the decision-making process.

Secondary stakeholders may include:

- Local citizens
- Other local government organisations. For example:
  - Neighbouring local government organisations
  - Local government organisations at different tiers (e.g., county council, combined authority)
  - Other departments from the lead local government organisation (e.g., housing)
- Large public sector, industrial, or commercial energy users in the local area.
- Community energy organisations.
- Net Zero Hub, LEP, locally based organisations with energy/decarbonisation expertise
- Social housing providers

The lead local government organisation has ultimate responsibility for determining which organisations it would like to contribute as primary stakeholders, and which organisations it would like to contribute as secondary stakeholders. The list provided here is not exhaustive; exactly who is involved in each LAEP will depend upon the local area.

Table 1 shows the Stages that each stakeholder may be involved in and contribute towards.

Table 1: Stakeholder involvement in each Stage

Stakeholder		Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6	Stage 7
Primary	Lead local government organisation	•	•	•	•	•	•	•
	Network operators		•	•	•	•	•	•
Secondary	Local citizens		•			•		
	Other local government organisations		•			•		
	Other departments		•			•		
	Large industrial or commercial users		•			•		
	Community energy organisations		•			•		
	Net Zero Hub, LEP		•			•		

Further information on the stakeholder roles and responsibilities is provided in Stage 2.

Post LAEP implementation and delivery

The roles and responsibilities identified here are limited to the creation of the LAEP. The implementation and delivery of the LAEP will likely involve the same set of stakeholders, but their roles and responsibilities may change, and additional stakeholders may also become involved. Stage 7 describes finalisation of the LAEP and details the next steps that stakeholders can undertake.

Stage 1.
Preparation

This Stage describes the preparatory work that an organisation must undertake to lead the creation of a LAEP. A previous study identified that local government organisations are best placed to lead the creation of a LAEP[14], and so this Stage is primarily aimed at and written for a local government organisation. Although it is primarily aimed at a local government organisation, it will also be of interest and use to any other organisation that is leading creation of a LAEP. Figure 2 shows the Steps in Stage 1. This Stage describes how to:

- Determine the geographical area covered and appoint the lead organisation
- Mobilise the lead organisation in order to lead creation of the LAEP.
- Determines the resources, roles, and responsibilities within the lead organisation.
- Assess the policy drivers
- Determine the scope of the LAEP.
- Commission creation of the LAEP.

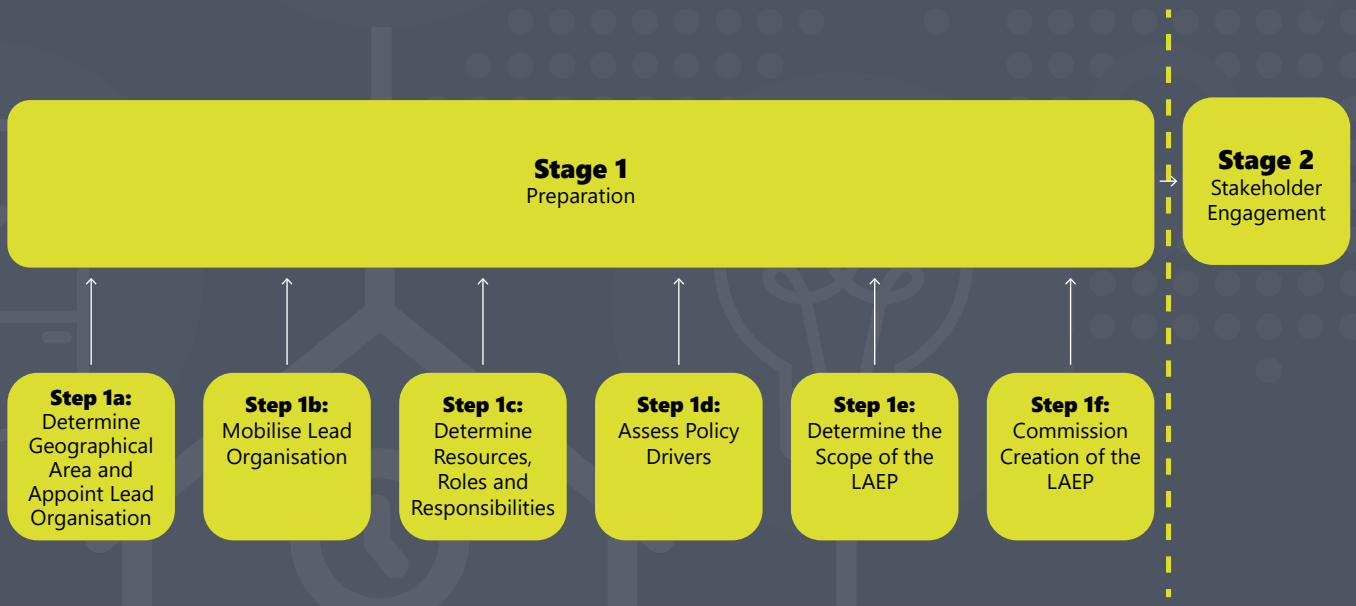

Figure 2: Steps in Stage 1, and relationships with other stages

14 https://es.catapult.org.uk/report/the-future-of-local-area-energy-planning-in-the-uk/

The purpose of this Stage is to get the lead organisation prepared for creating a LAEP before it involves stakeholders and external parties in the process. The lead organisation must understand and take ownership of the LAEP before the process starts in order for it to meet their needs when it is finalised, and because the LAEP will guide the lead organisation's and stakeholders' plans for reaching net zero when implemented. Having a clear idea of what the lead organisation wishes to get from the LAEP is also important; example questions the LAEP could answer include:

- Is it possible to meet net zero by the locally determined target date (i.e., 2040)?
- Does meeting net zero earlier than 2050 significantly increase the costs? What is the cost?
- What is the most feasible route to meet net zero? How does this change when priorities are altered?
- Which projects can be implemented now, and which ones are best left until later? What is the timeline for implementation? Who is best placed to deliver the projects that the LAEP identifies?

Step 1a Determine the geographical area and lead organisation

The first step in preparing to create a LAEP is to determine the geographical area covered and who is the lead organisation.

Objective: Determine the geographical area covered by the LAEP

The geographical area covered by the LAEP will need to be determined locally, and will need to consider:

- The characteristics of the locality, such as its mix of rural and urban areas.
- The relevant relationships between the local area and other local, regional or national / devolved government organisations.
- Whether any LAEP activity is already or imminently underway elsewhere in the region, or in neighbouring regions.
- Internal drivers, such as coverage of net zero policy or Climate Emergency declarations.
- External drivers, such as network planning activities.
- The funds available, and expectations of the funders.
- The time available to create the LAEP.
- Other resources, such as staff time.

All LAEPs created to date have had a geographical scope that has followed political boundaries; some are at the level of a single metropolitan borough council or city council, others are at county council or unitary level, and others are at combined authority level[15]. An upper limit for a LAEP is not specified; however, it is not recommended that a LAEP is created that covers an area smaller than a single borough or city council. At this scale, engaging with and being of interest to stakeholders (such as network operators and investors) will become too difficult.

When considering the geographical area that the LAEP will cover, it is also necessary to consider who will lead the creation of the LAEP. In some instances, the geographical area covered by the LAEP will only be served by a single local government organisation (i.e., a unitary authority) and so such a decision is already made. However, in many instances the geographical area covered by the LAEP will be served by more than one local government organisation (i.e., a borough and a county council; multiple borough councils and a county council; and so on) and so it is necessary to assign overall leadership responsibilities to a single organisation. The resources available and the capabilities of the local organisations are factors in the appointment.

Making this appointment helps to clarify the roles and responsibilities of the relevant local government organisations.

Step 1b Mobilising the lead organisation

Upon assigning the lead local government organisation, it is necessary to mobilise the organisation. Mobilising the organisation will require buy-in and support from the senior leadership and several departments across the lead local government organisation, and reference to and alignment with existing policies and drivers to enhance the case for support for creating a LAEP.

For example, the decision to create a LAEP is typically one taken on the back of adopting a policy made by a local government organisation, such as declaring a Climate Emergency or meeting net zero before a certain date. Gaining support from elected members and local government executives for creating a LAEP may have already taken place when such a policy was adopted, but if not, it is a critical initial step. The process of creating a LAEP and implementing it upon its creation is made much easier if support and buy-in from the senior leadership of the lead organisations is in place.

Step 1c Determine the resources, roles, and responsibilities within the lead organisation

The next step is to determine the resources available to the lead organisation and appoint staff within the lead organisation to specific roles and identify their responsibilities.

Objective: Identify the source of funding that is allocated to create the LAEP, the characteristics of the fund, and what it will be required to cover.

Funds may come from a budget that is allocated internally by the lead organisation, or from external sources. Both internal and external funds may have characteristics that affect how they are used (e.g., be time-limited), and what they can be used to cover (e.g., staff time only).

15 The combined authority's LAEP is made up of 10 metropolitan borough council LAEPs delivered individually, with delivery led by the combined authority

The lead local government organisation may be in a position to deliver all aspects of the LAEP, but it may be that external consultants are required to deliver specific aspects (e.g., stakeholder engagement, or complex technical aspects such as modelling, or quality assurance upon completion). Both may need to be covered by the funds made available to create the LAEP.

Funds may also be required to cover expenses incurred during creation of the LAEP; for example, to pay for hosting a stakeholder engagement event, or purchasing licenses to access data or software. Procuring external resources to assist in the creation of the LAEP has an impact on timescales for delivery as well as budgets.

In some instances, funds may not be available to cover the whole process of creating a LAEP from start to finish, and therefore it may have to be completed in two or more parts. This Guidance is modular, allowing a stage-by-stage approach to creating a LAEP that could be completed over multiple funding periods.

Objective: Appoint resources within the lead organisation to lead creation of the LAEP.

Appointing resources within the lead organisation, and their roles and responsibilities is the next step. When appointing resources, the following will need to be considered:

- Availability of staff to work on the LAEP.
- Expertise of staff to work on LAEP.
- Scope and scale of the LAEP.
- Budget available.
- (potential) involvement of external stakeholders, and what they may be able to undertake.

The lead organisation may find that a steering committee is the most suitable vehicle with which to drive creation of the LAEP. The steering committee may be made up solely of internal staff who represent the relevant activities, bringing their expertise to the creation of the LAEP from across the lead organisation. In the instance of a local government organisation leading, it may include:

- Senior leadership (e.g., Chief Executive, elected Members).
- Officers with responsibility for energy, sustainability, climate change.
- Officers with responsibility for planning, transport, housing.
- Officers with responsibility for development, skills, jobs, business support, and economics.

Whilst the steering committee may be made up entirely of internal staff initially - and may stay in this format - it may also grow to enable external stakeholders to be involved (see Stage 2).

It is important when resources are appointed that they are clear on their responsibilities. In the instance of a Steering Group being created (see Step 2c), it should be clear on its remit, and have a process in place for decision making in order for it to be effective. The role of each member of the Steering Group is as much to represent their area of the organisation and ensure that their area's requirements are aligned with the LAEP (and vice-versa), as it is to drive the creation of the LAEP. They may also provide data to assist in creating the LAEP (see Step 3a for more details).

An internal facing document should be produced that captures the decisions made by the lead organisations on the resources available, and the roles and responsibilities of those appointed.

Step 1d Assess Policy and Strategy Drivers

It is important during Stage 1 to assess the policy and strategy landscape. This assessment should look to include existing policies and strategies that are in place, but also any forthcoming policies and strategies that are due or expected during the lifetime of the LAEP. It should look to local, regional, and national policies and strategies that may be relevant.

The purpose of this step is to ensure that the LAEP that is created does not contradict or

prevent other policy or strategy targets being realised (e.g., doesn't deliver a decarbonised energy system that places more households into fuel poverty). Equally, it should look to incorporate policies and strategies that may deliver benefits that are congruent with net zero ambitions in a LAEP (e.g., ban on sales of new petrol and diesel cars after 2030).

This assessment is of particular relevance to modelling of future scenarios in Stage 4 and may inform the additional scenarios that a local area may choose to simulate.

Step 1e Determine the scope of the LAEP

The definition of LAEP that is described in the introduction provides a high-level overview of what a LAEP should include in its scope. A defining characteristic of LAEP that sets it apart from other types of decarbonisation planning and activities is that it takes a *whole-systems approach*, recognising that changes made in one part of the energy system will affect other parts of the energy system. To illustrate the integrated nature of LAEPs and the decarbonisation challenge, omitting *transport* from the scope of a LAEP may mean that network reinforcements are not identified to support heat electrification, but are when electrification of transport is included in a LAEP; further, omitting *industry* from the scope of a LAEP may mean that hydrogen is not identified as a viable option for heating domestic dwellings, whereas it is when industry is included.

A previous report[16] identified the following scope (Table 2) and actions (Table 3) that should be included in a LAEP, and follows the categorisation of local authority emissions that is published annually by BEIS[17]:

Table 2: Scope of a LAEP (blue dashes are 'optional' scope, and dependent upon the decisions of the lead organisation)

Scope – sources of emissions[18]		LAEP
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	—
Land use, land use change and forestry (LULUCF)	Forest Land	×
	Cropland	×
	Grassland	×
	Wetlands	×
	Settlements	×
	Harvested Wood Production	×
Other	Domestic Shipping	×
	Domestic Aviation	×
	Military Transport	×
	Exports	×
	International Shipping	×
	International Aviation	×
	Waste	×

16 https://es.catapult.org.uk/report/the-future-of-local-area-energy-planning-in-the-uk/

17 https://www.gov.uk/government/statistics/uk-local-authority-and-regional-carbon-dioxide-emissions-national-statistics-2005-to-2019

18 Emissions sources according to 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 04/03/2022

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. LULUCF is outside of the scope as LAEP focusses on the energy system.

Table 3: Actions required for a LAEP

Actions	LAEP
Stakeholder Engagement	✓
Robustly Costed	✓
Multiple Future Scenarios/Pathways	✓
Optimised Pathway	✓
Spatial Analysis	✓
Temporal Analysis	✓
Network Infrastructure Impacts	✓
Whole-Systems Approach	✓

Objective: Deliverable – Scope of Works

It is useful at this stage for the lead organisation to document the decisions made in a Scope of Works with regards to the geographical area and scope of the LAEP, and for this Scope of Works to be made available to stakeholders during Stage 2.

Step 1f Commission creation of the LAEP

Objective: Commission LAEP

The final Step in Stage 1 is to commission creation of the LAEP. Using this Guidance, the lead organisation should have full knowledge of what is required, as well as have the outline of a framework (i.e., senior level support, resources, roles and responsibilities identified, geographical area and scope) for delivery of the LAEP.

At this Step, the lead organisation should be in a position to procure external support for aspects of the LAEP that it cannot deliver in-house, or that will not be delivered by the external stakeholders (see Stage 2). Commissioning the creation of the LAEP *may or may not* require external support to be procured by the lead organisation; this will depend upon the scope of the LAEP, and the level of expertise in-house and across the stakeholders.

Of note during this Step, is the finalisation of the LAEP (Stage 7). Decisions that are related to the finalisation of the LAEP will determine what is commissioned in this Step and have a bearing on what is procured externally.

Stage 2.

Stakeholder Identification and Engagement

This Stage describes engaging external stakeholders in the process of creating a LAEP. The process of creating a LAEP is something that is collaborative, working with external stakeholders in order to best incorporate and represent local perspectives in the plan. Stage 2 commences upon completion of Stage 1; the lead organisation has completed all of the steps and objectives in Stage 1 and is ready to commence dialogues with external stakeholders. Engaging with stakeholders is an active Stage throughout the process of creating a LAEP, that is not complete until the LAEP is finalised. Figure 3 provides an overview of the Stage and its relationship to other stages in the Guidance. Stage 2 continues throughout the process of creating a LAEP, and therefore feeds into and runs alongside all stages that follow it.

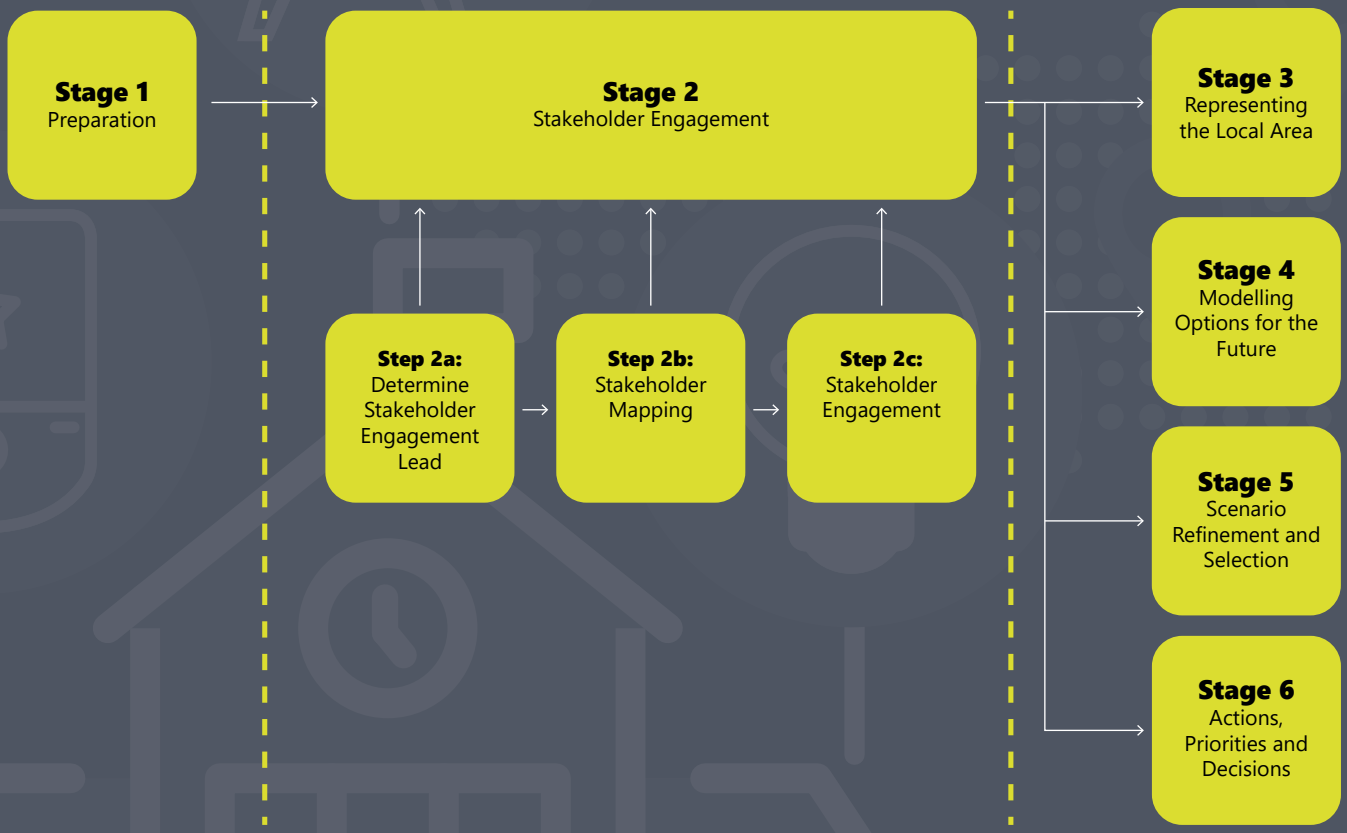

Figure 3: Steps in Stage 2, and relationships with other stages

The introduction detailed the types of stakeholders that may be involved in creating a LAEP, categorising them as being either primary or secondary. The types of stakeholders, and the Stages that they will be involved in, is shown in Table 4.

The key external stakeholders are the network operators, who own and operate the electricity, gas, and heat infrastructure in the local area. They are second only to the lead organisation with regards to having a critical role in creating a LAEP. Aside from Stage 1, they are involved throughout the process of creating a LAEP.

Table 4: Stakeholder involvement in each Stage

Stakeholder		Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6	Stage 7
Primary	Lead local government organisation	✓	✓	✓	✓	✓	✓	✓
	Network operators		✓	✓	✓	✓	✓	✓
Secondary	Local citizens		✓			✓		
	Other local government organisations		✓			✓		
	Other departments		✓			✓		
	Large industrial or commercial users		✓			✓		
	Community energy organisations		✓			✓		
	Net Zero Hub, LEP		✓			✓		

Step 2a Determine stakeholder engagement lead

Objective: Determine stakeholder engagement lead

The lead local government organisation must determine whether to lead stakeholder engagement themselves, or to procure external providers to undertake this on their behalf. The budget and timescales for delivery are a factor in the decision, but consideration must also be given to the capacity and ability of the lead organisation to undertake this activity if they wish not to procure external support. Therefore, external providers who specialise in stakeholder engagement may be ideally placed to undertake this activity; if a locally based organisation is available, rapport with stakeholders and existing relationships may already be in place. Alternative options to lead this Step include other departments within the lead local government organisation, or other stakeholders

Step 2b Stakeholder mapping

Objective: Assign roles and responsibilities, determine who is primary and who is secondary

The introduction detailed the types of organisations who are involved in creating a LAEP, categorising them as being either primary or secondary. Primary stakeholders are *responsible for creating* the LAEP, whereas secondary stakeholders are *responsible for supporting* the lead organisation in creating the LAEP, contributing to the decision-making process.

It is expected that the two types of stakeholders identified in the introduction are *always* involved as primary stakeholders (the lead local government organisation and network operators). These two primary stakeholders may be joined by other organisations who also contribute as primary stakeholders, but this will depend upon the characteristics of the local area and its priorities.

It is for the lead organisation to determine whether the following organisations listed here (or others not listed here) will contribute as either primary stakeholders, or as secondary stakeholders:

- Local citizens
- Other local government organisations. These may include, for example:
  - Neighbouring local government organisations
  - Local government organisations at different tiers (e.g., county council, combined authority)
  - Other departments from the lead local government organisation (e.g., housing)
- Large public sector, industrial, or commercial energy users in the local area.
- Community energy organisations.
- Net Zero Hubs, LEP, locally based organisations with energy/decarbonisation expertise
- Social housing providers

Assigning stakeholder roles and responsibilities will play a part in determining whether they are contributing as either primary or secondary. Some stakeholders have regulated or statutory obligations to fulfil and are governed by legislation, and this will determine their role (e.g., the licenced Distribution Network Operators and Gas Distribution Network organisations). Others may be focussed on the outcome from the LAEP, and delivery and implementation beyond its creation. Example roles and responsibilities for primary stakeholders are shown below.

A register of contact details of all stakeholders who are involved should be created.

Example: Licenced Network Operators as Primary Stakeholders

Who?

Licenced Distribution Network Operators (DNO) and Gas Distribution Networks (GDN) should always be primary stakeholders if they manage a network in the local area. If a local area contains more than one licenced electricity or gas network (recognising that local area boundaries do not correspond with network boundaries), the *prominent* network company may take the lead (subject to agreement between themselves).

What are they responsible for?

DNOs and GDNs are responsible for the operation, maintenance and development of local electricity and gas networks that serve a given region, as part of the national distribution system. They also have an obligation to both maintain the existing system and provide new connections. These organisations are regulated monopolies, who are required to submit their network development plans for approval with Ofgem. Under RIIO2 there is an obligation on network operators to consult with local government.

How will they be involved in LAEP?

Network operators could be involved in the process of creating a LAEP by:

- Providing data pertaining to the characteristics of the networks they operate
- Providing plans for maintaining and upgrading their networks
- Providing plans for supporting hydrogen as a fuel source
- Participate in the process of creating the LAEP, buying into and supporting the process

- Supporting implementation of the LAEP
- Utilising the LAEP in their own business planning activities
- Sharing their own future energy scenarios for the region

Other Network Operators

In addition to licenced network operators, a local area may contain a notable unregulated energy network operator, for example, a heat network operator or a private wire electricity network. Where this is the case, they can be considered as a primary or secondary stakeholder depending on their agency in the area.

Table 5 summarises the typical aspects where both local government and network operators can feed information into the LAEP process.

Table 5: Primary stakeholders feeding into the LAEP process

Common aspects	Data on the existing local area and energy system	Future projections and scenarios to explore in Stage 4	Potential heat networks	Existing and planned electric vehicle charging infrastructure	Key planned and current projects (e.g., energy storage, waste heat, innovation/demonstration projects, renewable energy, hydrogen hub)
Local government specific	Plans for decarbonising the built environment owned/ managed by local government	Public transport decarbonisation plans and infrastructure	Key industrial or non-domestic sites	Social housing stock and decarbonisation plans	Other plans that will inform the LAEP (e.g., climate, transport, development/ planning, environment)
Network Operator specific	Existing network constraints / limitations / headroom / capacity	Future expansion plans and costs (natural gas / hydrogen, electricity, and heat)	Opportunities for local flexibility to address constraints or other alternative investments	Existing development plans (agreed with the regulator), areas where uncertainty mechanisms can provide coverage for any expected capacity increases.	Alignment of plans for adjacent local areas (e.g., where there could be impacts to planned and existing infrastructure)

Objective: Identify issues of agency and conflict of interest

All stakeholders should commit to creating a LAEP that is in the best interests of the local area, and not prioritise their own interests to the detriment of others. A stakeholder should not use their role in creating a LAEP to unduly influence the process for their own benefit. Implementing the LAEP and decarbonising a local area to net zero will require significant investment, and the choices that are made as to how that investment should be used should reflect the best interests of the local area. Stakeholders should declare any conflicts of interest that they have, and this should cover declaring any possible financial gains that they may stand to make from implementing the LAEP.

Step 2c Stakeholder engagement

Objective: Create and onboard a Steering Group

A Steering Group is required to help guide creation of the LAEP. The purpose of the Steering Group is to provide a forum for the stakeholders to discuss and agree the approach in creating the LAEP at specific stages throughout the process. The Steering Group should assist the lead organisation in their decision making as they lead creation of the LAEP.

Primary stakeholders are the core of the Steering Group, with secondary stakeholders joining at specific times to assist in decision making. The lead organisation should determine who is required to attend when the Steering Group meets, with reference to the Stage that is in-flight, and the roles and responsibilities of each stakeholder.

Terms of reference should be drawn up and provided to the Steering Group as part of an onboarding process. A workshop may be required, at which potential candidates for the Steering Group are inducted to the process of creating a LAEP and made aware of the potential roles for themselves and their organisation.

Onboarding the Steering Group is a critical step in the process of creating a LAEP, ensuring it can effectively contribute to the process of creating a LAEP, and is aware of the expectations of the lead organisation. Each member should ensure that they are the most appropriate representative from their organisation to be involved.

It should be recognised that network operators, who are primary stakeholders and always involved in the creation of a LAEP, may simultaneously be required by multiple Steering Groups. Network operators are responsible for a large geographical area covering multiple regions, within which multiple LAEPs may be being created.

The terms of reference should detail the governance arrangements for creating the LAEP and the decision-making process of the Steering Group. It should document how to handle conflicts and disagreements that arise, both within the Steering Group and across the stakeholder groups more-widely. The lead organisation may take responsibility for ownership of the terms of reference or may work alongside the external organisation appointed in Step2a.

Objective: Produce a stakeholder engagement and consultation plan

An important determinant of success for implementing the LAEP is the extent to which external stakeholders have been engaged and consulted during the process of creating the plan. The LAEP will affect how homes are heated, people move around and how businesses and industry are powered, so it is important to bring local citizens along the journey.

Engagement activities collect feedback from secondary stakeholders at specific points during the creation of the LAEP (outside of the Steering Group process), or to collect views from specific types of stakeholders on specific aspects of the LAEP. Members of the steering group should not participate, but other representatives of their organisation could participate.

Broader consultation exercises may target householders, businesses, and other people and groups in the local area who are not considered to be a secondary stakeholder but who will have a view that shapes the deliverability of the LAEP.

The stakeholder engagement plan should map when, who, and how stakeholder engagement will occur and be tracked and updated as the LAEP is developed. The purpose of the stakeholder engagement plan is to ensure a robust approach is taken to engaging with stakeholders and can be shared with stakeholders to inform them of when they will be involved. It should also recognise any stakeholder engagement that is relevant and that has already occurred, perhaps as part of previous decarbonisation programmes.

The stakeholder engagement plan, engagement, and consultation exercises may be delivered by the lead local government organisation, or the external provider procured to support at Step 2a.

Engagement and consultation exercises can be carried out at any time throughout the process of creating a LAEP, but the following should be considered:

- If carried out early in the process, it can help shape thinking and guide the development of the LAEP. However, it may be too early to feed into selecting between future pathways.
- Repeated engagement may be useful to test and explore various options during their development as information and analysis is complete but can be inefficient if decisions are frequently revisited. If the same participants are repeatedly called upon, they may become fatigued and lose interest.
- If carried out late in the process, it can help to inform the local area of upcoming initiatives and projects and pathways identified. However, it may be too late to react if fundamental issues are raised.

To ensure a robust and transparent process, the perspectives and views shared by stakeholders during engagement should be documented and made available publicly. This should record who was involved during the engagement or consultation exercise, what their views are and when they were provided. It is important to ensure transparency, especially if agency and interests of stakeholders are concerns.

Objective: Have preliminary conversations with stakeholders about data availability

Stage 3 sets out the data that is required to understand and represent a local area. Some of these data may be provided by stakeholders, and so it is advised that during the initial engagement activities discussions about providing data commence.

Stage 3.

Understanding and Representing the Current Local Energy System

This Stage describes the work required in order to understand and represent the current energy system in the geographical area that the LAEP is being created for. It can be considered as a 'baselining' exercise; in order to successfully plan actions in a local area it is necessary to have a good understanding of the current system, its assets, infrastructure, ambitions, and currently committed plans for the future. As well as being the first step in planning for the future, this view of the current position may be of value to local stakeholders. Stage 3 commences upon completion of the steps in Stage 2 and must be completed before the modelling activities can commence in Stage 4. Figure 4 shows the Steps in Stage 3.

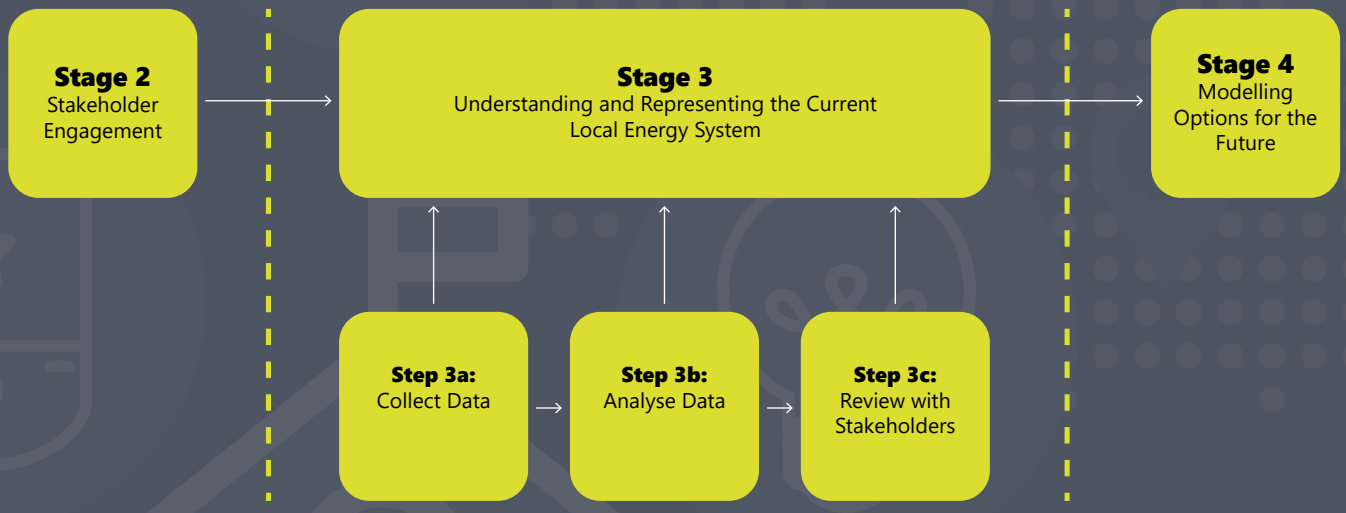

Figure 4: Steps in Stage 3, and relationships with other stages

Step 3a Collate data and information to understand the local energy system

To build a representation of the current situation it is necessary to collect and analyse data that that can be used to understand the local area.

Objective: Consider National Data Sources that can help represent a local area

The starting point for representing a local area is datasets with national coverage but that have a level of spatial detail that allows values to be extracted for a local area. Using these datasets allows consistency of approach between different local areas, should not require local stakeholder resource or effort to provide and can be processed and analysed using standard methods, rather than needing a bespoke approach for each area. This reduces the level of resource and effort involved in producing a LAEP. Local data can be added to them to better represent the local area, and this is discussed in the next section.

Table 6 sets out suggested datasets with national coverage that are valuable to this step of the process. Some of the datasets have UK coverage and some differ by nation. Where possible links to datasets have been provided. LAEP input data and assumptions that don't vary locally (e.g., the cost of technologies) are considered separately in *Annexe 2 - Standard Data Inputs and Assumptions for Local Area Energy Planning*.

Table 6: Suggested national data sources that can help represent a local area

Data Source	Link	Potential Role in a LAEP	Notes on use
Energy Performance Certificates	https://epc.opendatacommunities.org/	Provide data about the nature and energy performance of selected existing domestic building stock.	A large number of buildings will not have an EPC, and those that do are likely to be biased towards types of houses most likely to be sold more frequently or rented. Care can be needed when using attributes from EPCs as the data quality can vary.
National Atmospheric Emissions Inventory	https://naei.beis.gov.uk/	Help identify large point sources of emissions in a local area, likely to include the largest industrial sites.	Some of the company or organisation names in the dataset may not be up to date with recent takeovers and rebranding.
Ordnance Survey Mapping including Highways, Mastermap, Addressbase, Building Heights. Also, National Address Gazetteer, linking Ordnance Survey and local authority address data.	https://www.ordnancesurvey.co.uk/ (available open source at https://www.ordnancesurvey.co.uk/business-government/products/open-map-local) https://data.gov.uk/dataset/03d48dba-529b-4bd5-93a5-6d41d1b20ff9/national-address-gazetteer	OS datasets (including Mastermap, Addressbase, Highways) can help locate and identify buildings, road networks and key local infrastructure Local authorities have access to Ordnance Survey data free of charge under the public sector geospatial agreement and should be able to assign access to a contractor free of charge.	Combining different datasets is likely to be most effective, for example using both Addressbase and Mastermap to gain data on building footprints and uses.
OpenStreet Map	https://www.openstreetmap.org/	Open Street Map provides an alternative to Ordnance Survey mapping and is free of charge.	This is a 'wiki' style dataset updated by users.
Display Energy Certificates	https://epc.opendatacommunities.org/	Provides information about energy performance of public buildings.	Sometimes these certificates only refer to the public part of buildings which also have non-public areas.
Non-domestic Energy Certificates	https://epc.opendatacommunities.org/	Dataset of certificates giving energy performance for non-domestic buildings.	They are only required if the building has been sold, let or had significant construction work.
Housing Surveys	https://www.gov.uk/government/collections/english-housing-survey https://www.gov.scot/collections/scottish-household-survey/ https://gov.wales/welsh-housing-conditions-survey https://www.nihe.gov.uk/Working-With-Us/Research/House-Condition-Survey	Provide statistical data on likely housing attributes, which may be of use when more specific data (e.g., EPC) does not exist for a building.	There are some variations by country. Some of the attributes are considered sensitive data and require further licence agreements.

Data Source	Link	Potential Role in a LAEP	Notes on use
BEIS small area demand data	https://www.gov.uk/government/collections/sub-national-electricity-consumption-data https://www.gov.uk/government/collections/sub-national-gas-consumption-data	Provides estimates of electricity and gas demand, split into domestic (postcode level) and non-domestic (MSOA level).	Note that small non-domestics get classified as domestic, and so the split between the two may differ from other sources.
BEIS local area emission data	https://www.gov.uk/government/collections/uk-local-authority-and-regional-carbon-dioxide-emissions-national-statistics	Provides a breakdown of existing emissions at local authority level, by emission type and category of source.	The scope of these emissions may differ from the scope used in a LAEP.
National Charge point Registry	https://www.gov.uk/guidance/find-and-use-data-on-public-electric-vehicle-chargepoints	Inventory of some existing electric vehicle charge points, including locations and power ratings. Can be used to inform consideration of electrification of transport.	
Fuel Poverty data	https://www.gov.uk/government/collections/fuel-poverty-sub-regional-statistics	Provides an indication of fuel poverty by Lower Super Output Area, which may highlight areas that need to be targeted.	Further analysis to determine the specific house types most likely to be affected may be of value.
Valuation Office Agency data	https://www.gov.uk/government/organisations/valuation-office-agency/about/statistics	Provides information on activity and floor area of non-domestic buildings, which can be an input into estimating their energy use.	Note that the floor areas given are the rateable areas, which can be different to the overall building floor areas as they ignore certain uses.
National Travel Survey	https://www.gov.uk/government/collections/national-travel-survey-statistics	Statistics on travel patterns that might be useful for developing projections of EV charging demand.	There may be more local sources of data to replace this – charging profiles are likely to feature in DNO DFES work for an area and may also exist in work from sub-national transport bodies (e.g., Transport for the North).
Xoserve Off Gas Grid Data	https://www.xoserve.com/media/2687/off-gas-postcodes-v2.xlsx	Highlights postcodes without a gas connection.	This can include both more rural areas where a gas network does not exist, or urban postcodes where all the properties are flats (normally higher rise) without a gas connection.

Objective: Improve representation of area by identifying locally relevant datasets

Note: Although illustrated here, local data gathering is likely to happen throughout the process, in parallel with Stages 1 and 2. When discussing, onboarding or engaging with project stakeholders it is sensible to start setting out expectations in advance of what data they might be able to provide and to start the process of obtaining and collating it.

Local datasets are those that provide data about the local area but do not exist in a consistent form across multiple local areas. Although most local areas may have similar data, the format and level of detail may be different. Local stakeholders are likely to be essential in providing much of this data and should be consulted as to what might be available.

Local data is likely to be considerably more resource intensive to source and use than national data. It will take a higher level of effort not just from the organisation producing the LAEP, but also stakeholders who might be asked to provide the data.

Table 7 sets out examples of commonly available local data types, that are typically valuable when creating a LAEP. This list is not exhaustive, and local stakeholders should be consulted to understand what might also be available and of particular value in the local area.

Table 7: Commonly available local data sources

Data Source	Likely Owner	Potential Role in an LAEP
Local Plan	Local Authority	Identifies local ambitions, including carbon, growth and planning constraints. Less likely to provide numerical data but provides input to guide modelling approach.
Housing Allocations	Local Authority	Areas where new developments are likely to be located. May also provide information on the types of buildings planned in the area.
Distributed Future Energy Scenarios (DFES)	DNO	Existing modelling of future energy scenarios for an area, that may be useful input into future options and potentials rates of change. DFES are done at a higher level and may not currently reflect individual local authority carbon targets.
Local Authority assets register	Local Authority	Highlights buildings and vehicles owned by local authority, which may be easiest to target in the short term or may provide opportunities for particular technologies.
Social Housing stock data, potentially including planned future works and developments	Social landlords and housing associations.	Can provide more detailed information about a subset of domestic buildings in the local area. May be necessary to prioritise only working with the largest social landlords, to get the maximum amount of data coverage for the effort. May represent a set of buildings easier to target in the short term.
Future heat network scoping studies	Local Authority – potentially funded by Heat Network Development Unit.	This may represent detailed planning of specific heat networks that might be included in the plan, or a higher-level scoping study of potential areas. Stakeholder engagement might be required to understand how likely these plans are to happen.
Transport Plans	Local Authority, Regional Transport Body.	Help assess future demands for EV charging, and locations of significant charging hubs. May include future ambitions for fleets or public transport and provide aims for modal shift between transport types.
Renewable generation site scoping	Local Authority	Existing studies assessing potential for local renewable generation can help guide how much could be available in the future. Detailed local studies may have been able to take more account of specific local factors than a higher-level scoping study would use.
Environmental Plans	Local Authority	May be linked to a local plan. Provides guidance on carbon reduction targets and other environmental constraints that a LAEP may need to meet. A common one would be Air Quality Management Areas.
Electricity Network asset data	DNO	Data from the DNO about their local electricity assets, including substation and feeder location and capacities. These help the LAEP understand the need for flexibility and network reinforcement. Data may be more available for primary substations compared to secondary.
Gas network asset data	GDN	To help identify what area of their network is currently suitable for hydrogen, and where further mains replacement is required. This is likely to be guided by data on existing pipe pressures and materials.
Existing heat network data	Heat network operator	Where a heat network already exists, further information on buildings served, heat source used, potentially levels of demand and possibilities for expansion.
Demand data for significant sites	Variety of site owners, but most commonly available is large public sites such as hospitals. Through engagement may be possible to get data on some large industrial sites.	Helps ensure the LAEP is correctly representing the demands of the most significant local sites.

Objective: Assess the value of local datasets. Prioritise working with those likely to be of most value in the LAEP process compared to the level of effort to use them.

Those delivering the plan will need to assess and judge which of the identified locally available datasets to use. The resources required to process and use a dataset will vary by area, and the value of the dataset will vary according to local priorities.

When making this judgment, factors to consider include:

- The level of effort required from stakeholders to provide the dataset.
- The level of effort required to make use of the dataset once provided, such as working it into a useful format. Consider if it will need a bespoke method, or if it is similar to other datasets.
- The area the dataset covers. Once sourced and processed will it provide data relevant to a few local buildings, or the whole local area?
- Length of time covered. Does the dataset provide information relevant to the long term or does it represent a short period (e.g., a single year's demand data)?
- Is it recent, is the dataset up to date?
- Are there any confidentiality or data protection restrictions that make it harder to use?
- How easy is it to combine with other datasets? (e.g., does the dataset use common identifiers (see section below)
- What level of impact is it likely to have on the findings of a plan?
- Are there alternative datasets that might provide similar coverage (these may be national or local)?

The above factors can be grouped into considering two characteristics of the local dataset:

- The effort required to use the dataset
- The level of impact it will have on the LAEP if it is used/not used

As a rule-of-thumb, *low effort high impact* datasets should be prioritised, and *high effort low impact* datasets should be deprioritised. Beyond this, it needs to be a judgement call based upon the above factors, and the time and resources available to stakeholders.

The LAEP should also reference local datasets that were *not used*. Referencing datasets that were not available or have not been used, with actions for stakeholders to make them available or improve them so that they can be used, may help a local area create a better LAEP in the future.

Objective: Use common geospatial data units when working with local and national data, following the government standards where possible.

Working with spatial data becomes more efficient when it is easy to combine different datasets through the use of *common identifiers* for buildings, roads and small areas. This allows different datasets to be more accurately and easily combined, and the outputs to be visualised. Processing data in this way also makes any future updates to the plan and any scaling up to regional and national level easier. The government open data standards on this should be followed where it is possible to do so[19] and Ofgem Data Best Practice Guidance followed[20]. Table 8 summarises the key identifiers, but the full guidance should be consulted.

19 https://www.gov.uk/government/publications/open-standards-for-government/identifying-property-and-street-information

20 https://www.ofgem.gov.uk/sites/default/files/2021-11/Data_Best_Practice_Guidance_v1.pdf

Table 8: Suggested common spatial data identifiers to be used

Identifier	Further Info	Link
UPRN – Unique Property Reference Number	Numerical code used to uniquely identify individual properties across the UK, much more efficient to match than addresses.	https://www.geoplace.co.uk/addresses-streets/location-data/the-uprn
USRN – Unique Street Reference Number	A unique numerical code to reference each street.	https://www.geoplace.co.uk/addresses-streets/location-data/usrn
LSOA/MSOA – Lower and Middle Super Output Areas. Boundaries defined for statistical purposes by ONS (e.g., not specifically for energy purposes).	Census geography areas often used for socio-economic data. Each represents an area of approximately similar population. These are not defined in the government open data standards.	https://www.ons.gov.uk/methodology/geography/ukgeographies/censusgeography

Objective: Make use of existing local modelling and analysis but assess its suitability for inclusion.

Some of the existing data for a local area might be derived from studies that have already undertaken modelling or analysis of future options. This can be a key input into the LAEP process but needs to be assessed as to its suitability for inclusion. An assessment as to the relevance, independence, scope and quality of the work should be made, as well as considering the benefits from re-using previous work such as being consistent with previous studies and avoiding duplication. A judgment should be made that considers these factors and recognises that in some cases partial re-use of datasets may be an option. Examples to consider include using data or information from:

- Distribution Future Energy Scenario (DFES)[21] that has been produced for the local area. For example, where the DFES includes information on existing and planned assets, as well as proposed projections for technology uptake, projects, and future energy demands, particularly where these have already and recently been agreed with the local area
- Gas Distribution Networks or other organisations plans for gas to hydrogen conversion or hydrogen provision in an area. In this example, consideration would be needed with regards to costs (CAPEX and energy use), carbon content and timescales for provision etc.
- DNO and GDN business plans that have been submitted to Ofgem regarding network investment plans[22]
- Plans for new heat networks in an area.

These examples are relevant for this objective, the one below and potentially to feed into the modelling and scenario steps and objectives described in Stage 4. The organisation undertaking the relevant aspects of Stages 3 and 4 will need to identify and consider where such information could be used.

21 https://www.westernpower.co.uk/smarter-networks/network-strategy/distribution-future-energy-scenarios other DFES examples are provided by each Distribution Network Operator

22 ED2 plans will be in place from April 2023

Objective: Include future plans in an area where there is an appropriate level of commitment

Information pertaining to future local development plans may be included in creating a LAEP. However, an assessment and judgement are required to understand the likelihood of the development being delivered. A judgement should be made as to whether to include the development as certain, an option, or exclude from future analysis.

The criteria for making this decision could include:

- How recently the plan was made.
- Has committed funding been identified, is more required?
- The level of detail in the plan – is it a feasibility study, is it a full design? Is more planning required before the development can occur?
- Feedback from local stakeholders as to the likelihood of the plan taking place.

Where there is certainty, it is important to incorporate these existing activities to ensure that the plan is relevant and additive, rather than duplicating or even contradicting efforts. These plans may come from a variety of sources, including, for example, local authorities, local enterprise partnerships, private developers, or network operators.

Objective: Understand the present-day delivery and operational context

It's crucial that the plan begins from where the local area is currently, avoiding a gap between the starting point of the plan and the true starting position of the area. This relates to factors such as policy (see step 1c), planning, capabilities as well as political ambitions. Further, an understanding of the local area's ability to implement the solutions that will be recommended in the plan is needed, so that the first steps of initiating and implementing the plan can be tailored to the local area. An entry checklist or assessment to understand where the local area is as it embarks on the process may assist this (e.g., it may have already completed some early steps in the process).

Step 3b Undertake analysis of current data

Objective: Analyse the collected local and national data to represent the key features of the current energy system.

It is necessary to use the collected data to develop an overall representation of the local area, highlighting key features. Table 9 sets out the key features to be represented. The 'At a minimum' column describes a requirement for the minimum level of detail that must be included at this stage of the LAEP; the 'Going further' column is a recommendation for further detail that could add value but isn't a necessary requirement.

Objective: When representing the local area, it is necessary to adopt an approach that can also be used for the future modelling.

At this point, it is necessary to consider the choices that will be made during Stage 4; it is critical that the representation of the current energy system that is developed now is one that can be worked from in Stage 4. Whilst this is important from a modelling perspective, it is also important for stakeholders to review and comment on consistent approaches to both the current and future energy system.

An example is modelling current and future domestic building energy demand. It will be necessary to understand how replacing heating systems or energy efficiency retrofit affects modelled future domestic building energy demand. The approach adopted now to represent the current demand must have the function to integrate these future changes across time. If the representation of current demand is static datasets (e.g., loads provided by network operators, or BEIS's small area demand data) then this can't capture and integrate future interventions.

It is included at this stage as it is important that the considerations required for the modelling of future demand are reflected in the model of current demand. The same principle can apply to other features.

Table 9: Energy System features to be assessed

Feature	Relevance to LAEP	At a minimum	Going Further
Current Emissions	Must understand the current emission level in order to identify what needs to change to reach a carbon target.	A breakdown of scope 1 and 2 emissions by sector.	Spatial mapping of emissions, including large point sources. This shows how emissions vary across the local area. It is necessary to determine how scope 2 emissions (e.g., those associated with electricity generation) are represented, whether they should be shown at the point of emission or at the ultimate point of energy demand.
Current demand by sector and location	Need to understand current demand both to help calculate future demands and also to put any demand changes in context.	Demand by energy and use type, for sections of a local area (e.g., estimated electricity and gas demand split between domestic and non-domestic buildings).	Detailed mapping of demand, potentially down to building level.
Existing substation headroom	Understanding available capacity in substations before reinforcement is required.	Understand existing substation headroom under current conditions, in particular understanding those areas most at risk, there may be situations where networks are unable to provide this data, if this is the case then this may have to be excluded.	Capacity, topography, how network assets and buildings are connected to the networks, demand and therefore headroom data for each local substation.
Existing EV charging infrastructure	Helps assess how much more EV charging infrastructure may be required.	Mapped locations of significant amounts of EV chargers in one place (e.g., at a charging hub).	Mapped locations and power ratings of public and workplace chargers, alongside any committed future plans for more.
Existing domestic buildings	Significant source of energy demand in most local areas that needs decarbonising.	Building types, ages, floor areas and how these vary across the local area.	Existing energy efficiency rates, insulation levels, data on tenure (owner occupied, private rental, social housing).
Existing Non-Domestic Buildings	Significant source of energy demand in most local areas that needs decarbonising.	Floor areas and activities – what the building is being used for.	More detailed energy demand data for specific sites if available.
Current Gas network	To understand existing energy supply.	An understanding of which areas are not served by the current gas network.	Understanding of current pipe lengths and materials in order to later best represent remaining costs of converting to hydrogen.
Energy Demands over whole area	Gives overall picture of demand for a local area, helping to illustrate needs for generation.	Peak and annual electricity and gas demand.	More detailed daily profiles of demand.
Existing local generation and storage	Understand what energy is currently being generated and stored locally.	The total annual generation and storage from each type of technology.	Specific locations within the local area for each technology, generation profiles over time.
Planning constraints on development (e.g., national parks, listed buildings)	Helps identify where some options may be limited.	Mapping of the key areas.	Further discussion of what limitations each constraint may bring, mapping of individual listed buildings.
Socio-Economic situation (including fuel poverty)	Important context to future plans, may identify areas that need certain measures targeting.	Identification of areas with highest levels of fuel poverty locally.	Further socio-economic indicators mapped, such as Index Multiple Deprivation.

Feature	Relevance to LAEP	At a minimum	Going Further
Existing heat networks	To help understand existing energy sources.	Representation of existing heat networks including the buildings connected and the heat source used.	Including data on any excess heat or network capacity that might be available for network expansion.
Committed future plans	Across the energy system, things known to be certainly happening in the future should be included in the plan.	Certain and significant local developments should be documented, including what they are, where in the local area they are sited and when they are likely to occur. This could include buildings, networks, generation and transport.	Also include a consideration of future plans that are not yet certain but include any details on their likelihood of going ahead.
Available roof space for new PV (domestic and non-domestic)	Helps understand the potential to generate low carbon energy locally.	An estimate of potential roof space for PV based on total domestic and non-domestic roof areas and an estimated fraction that would be suitable.	More detailed analysis of rooftop suitability including consideration size, angle, pitch on a per building basis.
Land for other renewable generation	Helps understand the potential to generate low carbon energy locally.	A high-level estimate of potential for other forms of renewable generation (e.g., ground mounted solar, wind).	Detailed mapping of suitable sites for further generation, with calculated potential capacities.

Step 3c Review representation of current system with key stakeholders

Objective: Present view of the current energy system to local stakeholders

Once the representation of the current energy system is developed, it must be discussed with the Steering Group. Providing the representation of the current energy system to the Steering Group overlaid on maps of the local area in a visual format can assist dissemination and their understanding. The Steering Group should be consulted as to their feedback, whether anything is wrong, missing, or does not match their expectations of what they think their local area energy system 'looks' like.

If the Steering Group suggest aspects are missing, then it is necessary to prioritise their inclusion in the same way as local data was judged, by assessing effort and impact. The Steering Group suggesting that an aspect is inaccurate may lead to a re-examination of the data. However, there may be situations whereby an individual's opinion or perceptions are not accurate, and it may be necessary to demonstrate this to them.

The representation of the current energy system can have value to a local area as a standalone piece of work outside of LAEP and could be discussed with local stakeholders beyond those included in Stage 2.

Objective: Compare and validate findings against other data sources

Once the Steering Group has reviewed and provided feedback on the representation of the current energy system, it can be compared and validated against *other*[23] data sources. It is important to undertake this after the Steering Group has provided their feedback, to ensure that local perspectives have been incorporated and increase the chances of an acceptable validation.

No data will be a perfect source of information, and it is not realistic to expect the representation to perfectly align with other data sources. A comparison should be made that seeks to explain any variance. If the variance between the representation and actual data is

23 If used for validation, these are data sources that must not be used in the initial activity of representing the energy system

systematic (e.g., the representation consistently under or over predicts something) then this is likely to be of more concern than if the differences are more randomly distributed. Potential sources of data to validate against are shown in Table 10.

To build confidence with the Steering Group, the findings of this comparison and validation should be presented to them, along with an explanation of differences.

Table 10: Potential sources of validation

Data Source	Reference	Potential Use
BEIS small area demand data	https://www.gov.uk/government/collections/sub-national-electricity-consumption-data https://www.gov.uk/government/collections/sub-national-gas-consumption-data	Validate present day energy demands. The BEIS data also contains some elements that may be modelled, so there may be situations where significant differences between the two are expected. If comparing at sector level, note that that the BEIS approach to apporting demand between domestic and non-domestic is based on annual demand levels and so may lead to differences to an approach based on building classifications.
DNO/GDN demand data at substation or feeder level – peak or throughout the year	Provided by local network operators	If short-term, then may need to weather-correct for the time period in question in order to compare to a longer-term average.

Objective: Agree current representation complete and appropriate to be taken forward into future modelling

A final 'sign-off' of the representation of the current energy system is required before moving onto Stage 4. This final version of the representation of the current energy system may have changed on the back of incorporating Steering Group feedback and validation against other data sources. By approving the representation, the Steering Group are confirming that this Stage is complete and is a suitable base upon which to build the future modelling in Stage 4.

Any discrepancies and uncertainties that remain should be captured in the LAEP. Actions to resolve them should be considered as recommendations prior to undertaking a future LAEP.


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Stage 4.

Modelling Options for the Future

Stage 4 builds on the representation of the local area defined in Stage 3 and undertakes the modelling of future options. The purpose of Stage 4 is to define for each scenario which combination of actions in a local area reaches the carbon target in the most effective way. Stage 4 cannot commence until Stage 3 is complete and is finished before Stage 5 commences.

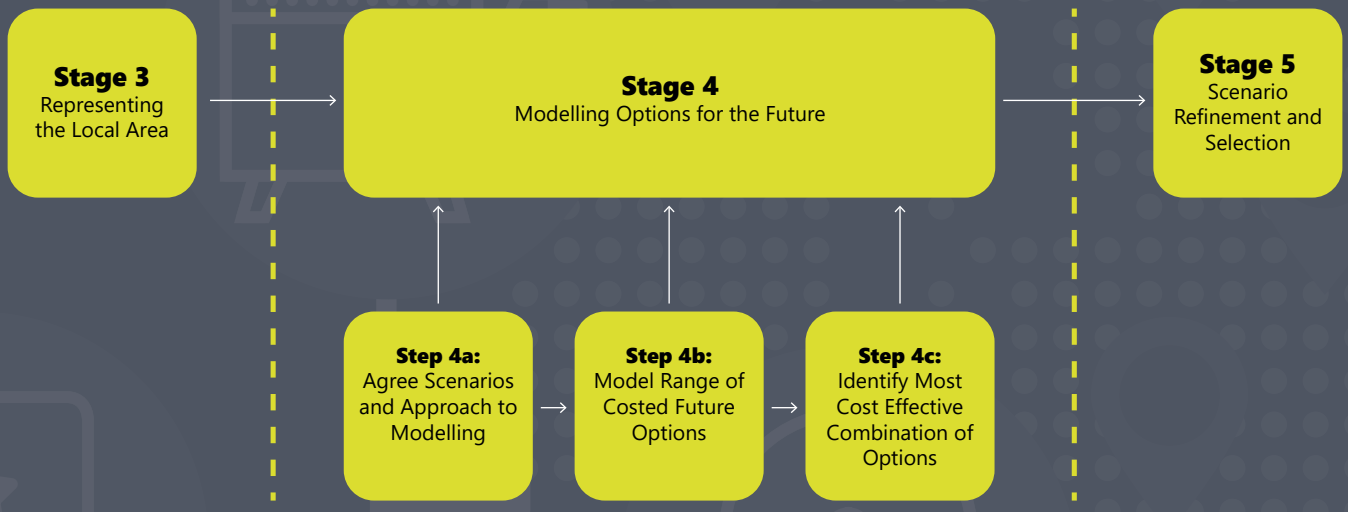


Figure 5: Steps in Stage 4, and relationships with other stages

There are three steps in Stage 4 that are undertaken consecutively (Figure 5). Firstly, a number of scenarios must be selected and agreed with stakeholders. By considering multiple scenarios, rather than a single scenario, options and choices for how to meet net zero can be considered. Alongside this activity is the need to agree the approach to modelling, determining how modelling concepts (e.g., time resolution) are incorporated. Once this preparatory work is completed, modelling the range of costed future options to decarbonise the area can commence, assessing these options to understand how suitable they are, and what they mean in terms of costs, energy demand, CO_2, and so on. The final step seeks to identify the most cost-effective combination of options in each scenario, ready for further assessment in Stage 5.

Step 4a Agree scenarios and approach to modelling with stakeholders

Objective: Agree with primary stakeholders the scenarios to be considered during the project

Scenarios are needed to consider both varying options for an area to decarbonise, and assess uncertainty in input values into the modelling, including uncertainty in future policy. Modelling multiple scenarios (as opposed to a single scenario) helps to identify those measures that are likely to be required in all future scenarios, and therefore are termed 'low regret' actions, that can be fed into pathways.

It is important that the scenarios considered represent the potential decarbonisation options that reflect the requirements of the primary stakeholders. This is necessary to ensure primary stakeholders support the process of developing the LAEP and that the process is collaborative and transparent.

Objective: Include at least two nationally consistent scenarios

In order to be compliant with HM Treasury Green Book[24] [25], the approach should allow sensible scaling up of LAEP results to regional and national level and therefore there is a need for consistent scenarios to be undertaken in LAEP.

A LAEP must include at a minimum the following two 'core' scenarios:

1. A 'Do Nothing' scenario

This scenario reflects only decarbonisation activities between now and 2050 that are committed to happen (e.g., the ban on new petrol and diesel cars after 2030 and ban on gas boilers in new builds after 2025). It does not recognise policies that are not tangible and finite activities (e.g., net zero). This scenario does not show a pathway to decarbonise a local area, but instead acts as a baseline against which other scenarios can be compared. For example, it provides a baseline of the costs of energy system upgrades (such as end-of-life boiler replacements) against which costs to decarbonise an area can be compared. This scenario requires less analysis than a scenario with a carbon target, does not allow the local area to identify a pathway to net zero, and as noted should be used as a baseline only.

This scenario is compliant with HM Treasury Green Book guidelines[26].

2. A net zero target in line with national guidelines

This scenario should reflect the net zero target of the relevant country at the time the plan is made (e.g., currently 2050 in England). It should not take account of a locally set net zero target. As well as a target date by which net zero is met, it should also consider intermediate emissions targets set by the Committee for Climate Change and UK Government (e.g., a 68% reduction by 2030, 78% by 2035). Some of the options to meet net zero may not be in scope of the local modelling (e.g., options for negative emissions such as carbon capture and storage that occur outside of the local area), in which case the scenario should look to minimise local emissions, and the plan should describe the negative emission options and how they might play a part in meeting net zero. The purpose is to provide a scenario against which locally chosen scenarios can be compared; for example, if a local area chooses a date sooner than the national target by which net zero must be met, the effects are understood.

This scenario is compliant with HM Treasury Green Book guidelines.

Objective: Consider modelling additional future scenarios

The two 'core' scenarios identified above are the minimum required, and it is very likely that a local area will choose to model additional future scenarios. A typical choice of additional scenario is one that meets a local net zero target date that is sooner than the national target (e.g., by 2040), and is likely to be the main interest of the LAEP. In addition, energy network operators (who are primary stakeholders) may be interested in exploring decarbonisation scenarios that reflect views around electrification and / or the use of hydrogen. The 'additional' scenarios can be compared with the 'core' scenarios to understand how they change what the future for the local area looks like in terms of emissions trajectories, costs, and technology deployment rates (alongside other techno, economic and wider factors described in Stage 5), for example. For consideration is compliance with HM Treasury Green Book, that recommends

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

25 See also Annexe 3 - Guidance for Socio-Economic Analysis in Local Area Energy Planning

26 Labelled 'Business-as-usual' it states "the result of continuing without implementing the proposal under consideration. This is true even when to continue with BAU would be unthinkable"

a 'preferred pathway' and one or more other possible options based upon realistic 'more ambitious' or 'less ambitious' pathways.

Beyond modelling a locally derived net zero target, further additional scenarios can test key uncertainties, or understand how scenarios can deliver local benefit. Examples of scenarios that have been considered in LAEP work to date include:

- Local carbon targets (a target for emissions in a particular year) or a carbon budget (a total amount emitted by a certain date). In some instances, a range of different carbon target dates has been 'tested' by modelling, in order to inform the selection of the carbon targets, or to highlight which actions are of value across many different carbon target dates.
- Different rates of future decarbonisation of grid electricity, in order to assess how this impacts the rate of decarbonisation possible in the local area.
- Different levels of opportunity for local production, generation, and storage, in order to reduce dependency on the national grid, up to a potential scenario of 'islanding' where the area seeks to generate all the energy it requires.
- Differences in future energy prices (covering gas, electricity, heat, and hydrogen). Testing different prices for future energy can show the extent to which possible changes in future prices change the lowest cost plan.
- The deployment of specific local energy projects, such as planned heat networks. This can help identify how they could fit into the plan and whether further expansion is viable.
- Different assumptions around opportunities for flexibility to reduce peak demand and reduce the requirements for network reinforcement. This may include different demand profiles for heat pumps assuming greater use of thermal stores, smart charging for electric vehicles, or greater use of building or network scale batteries.

- Testing options for using hydrogen as a heating fuel, including different timescales for availability and assumptions around cost and carbon content. This has included modelling specific local schemes such as HyNet and East Coast Hydrogen.
- Testing existing network operator projections for future change in an area, such as those in a DFES study.
- Testing options that prioritise the reduction of energy demand, considered alongside the relationship with energy costs, for example, to target resource towards reducing fuel poverty
- Considering combinations and options that are more likely to result in providing benefit to the local area over other scenarios (e.g., relating to local job creation)

The additional scenarios to be modelled should be agreed with the Steering Group. The number to include will depend on the local importance of the topics, the complexity of doing the scenarios and the budget and timescales allocated for the work. Modelling more scenarios increases the level of insight that can be taken into the pathway production process (Stages 5 & 6) and helps identify near-term components across scenarios.

Objective: Agree modelling approach with Steering Group

This objective concerns the approach to a number of characteristics of the modelling. The modelling approach is set out in Table 11, and details the minimum standards that must be met, as well as options to go further (if desired).

The decisions made against these characteristics affect how the scenarios are modelled and the resulting outputs generated (e.g., modelling a scenario on an annual basis gives a greater resolution than modelling on a 5-yearly basis). The Steering Group should discuss and agree on the decisions made against each characteristic and understand how they affect the modelling of scenarios before modelling commences. Further, agreeing the modelling approach may mean that the selection of scenarios may need to be re-visited.

The level of interest in the details required by the modelling is likely to vary by area, and so should be guided by discussion with the Steering Group. It may be of value to demonstrate previous quality assurance or model validation that has taken place.

Table 11: Characteristics of the modelling

Characteristic	At a minimum	Going further
Time resolution	An understanding of the system on an annual basis and at peak times	Representing a full range of characteristic days and times, for example spring, summer, autumn, winter, weekends and weekdays and different times of those days. Depending on the approach going as far as half hourly across the year may be of value, but this would add cost and complexity.
Time period	Showing change over time between now and 2050 (regardless of the local emissions reduction target). A minimum of 5-year time periods leading up to the emissions reduction target, and a minimum of 10-year time periods afterwards (if the carbon target is before 2050). This enables the plan to identify when interventions should happen.	A greater time resolution, for example increasing up to an annual basis
Spatial Resolution	In order to help make a plan that can be used for deployment, the modelling must be able to identify where within a local area the intervention would be best located; it should not consider the whole area as a single place. At a minimum this should break the overall area down into zones, and these zones should be identifiable to the stakeholders. These zones should be used to apportion demand to specific sections of network infrastructure. The number of zones and their characteristics (i.e., size) is dependent upon the local area's preferences.	The spatial resolution can be increased, with more zones or potentially identification at postcode or building level. If taken to a very high level of spatial resolution, then guidance should be given as to the quality of data available for each area (e.g., if it only covers a small number of buildings, it should be clear to what extent the building data was available or assumptions were made).
Energy system scope	The approach should focus on the energy system infrastructure that can be considered local in nature. This should include those energy networks designed to serve the local area (e.g., distribution level infrastructure rather than transmission). For electrical networks the precise voltages levels for this may vary by area. Energy generation should be considered local where the key input to energy production is a local resource (e.g., wind and solar generation, where the amount generated is partially driven by the amount of local land dedicated to them). Generation where the key resource comes from outside the local area (e.g., imported biomass) should not be considered in scope, and should instead be considered part of the national energy system.	If considering LAEPs for a number of areas in proximity to each other it may be of value to consider whether any of the system in scope is shared between the areas, for example if local generation in one could contribute to multiple areas. This is more likely to be the case if the areas come under a shared body, such as a combined authority.
Weather	An understanding of both the annual averages and the potential peak winter conditions in the area to be studied, in order to correctly model peak heating requirements	Similar to the time resolution, weather data could be used for other times of the year.
Climate change	Represent the current climate	Represent likely changes to climate over time between now and 2050, reflecting the possible impact on heating and cooling demand
Representation of demand	See Table 12	

Step 4b Model range of costed future options for the area

Objective: Define the range of decarbonisation options

The purpose of this objective is to identify the range of options for decarbonisation that could be deployed. These options can broadly be split into two categories; those that directly influence energy demand by changing the quantity of energy required or the energy vector used (e.g., a change in heating system), and those that provide the supporting infrastructure for these changes (e.g., network reinforcements). Table 12 describes the minimum *demand changing* options, and Table 13 describes the minimum *infrastructure* options.

Table 12: Demand changing options

Source of energy demand	At a minimum	Going Further
Domestic Buildings	Representation of fabric improvement and heating systems including gas boiler, electric resistive, heat pump, district heat, hydrogen.	Multiple options for fabric improvement, multiple versions of heating systems for example different types of heat pump, variety of thermal storage sizes, changes in occupant behaviour.
Private Transport	A switch from present day demands for road fuel for cars to be replaced by electric demand for EV charging.	Changes in transport energy demand based on behavioural changes and modal shifts. Public transport including decarbonisation of buses and rail. Goods vehicles including options to convert to hydrogen.
Commercial Buildings	Energy demands split into heat and other, with options to switch the heat to other energy sources (if it is not already electric).	A range of different ways of generating heat (e.g., different types of heat pump, fabric changes to the building, behavioural changes).
Industry	Options to meet heat demand, with a consideration of whether it is space or process heat. The low carbon options for process heat should be limited to those able to meet the needs, for example electrification may not be suitable for some use cases.	Detailed understanding of the industrial processes occurring in a local area and a range of decarbonisation options for each one.

Table 13: Infrastructure options

Infrastructure	At a minimum	Going Further
Electricity Substations	Costed options to increase LV and HV substation capacity, flexibility as alternative to reinforcement.	Multiple options to increase LV and HV substation capacity.
Electricity Feeders	Costed options to increase LV and HV feeder capacity.	Multiple options to increase LV and HV feeder capacity, flexibility options as alternatives to reinforcement.
Gas network	Where a gas network currently exists, the option to repurpose it to hydrogen.	Blending of hydrogen or biomethane into the existing gas grid. The cost of grid development and / or repurposing being dependent on existing gas network pipe materials. The cost of decommissioning parts of the gas grid if demand falls below a sustainable amount in a local area.
Heat Networks	Energy centres with a source of low carbon heat, approximate cost of pipework installation to supply the heat to local buildings.	Spatial routing of heat network, detailed costing of pipes depending on precise buildings connected.
Storage	Thermal stores (e.g., hot water tanks) and batteries modelled as options in buildings.	Include grid scale storage (e.g., large-scale batteries), hydrogen.
Local Production and Generation	Options to increase local low carbon energy production, and electricity generation, such as wind and solar. Local generation is defined as that where the key resource that controls the amount of energy production is sourced from the local area. In the case of wind and solar this is considered to be the amount of local land on which they are situated. Options like a biomass plant that take biomass from a much wider area than the local area are not considered local and are not in scope.	A more detailed understanding of where new local generation could be sited, by mapping land that meets certain requirements (e.g., proximity to and cost of connection). Opportunities for local heat generation, such as river or sewer source heat pumps, waste heat from industrial sites.
Negative emissions	Not directly modelled but potential options for mitigating remaining emissions are discussed in plan.	Incorporate into modelling with costs and carbon saving impacts that can be compared to other measures.
National Energy System	The costs and carbon contents of energy products entering the local area (e.g., electricity, gas and hydrogen).	Greater time resolution for the costs and carbon contents, reflecting different times of day and year. For hydrogen, representing the costs and carbon from the regional level project that might supply the area, such as HyNet or East Coast Hydrogen.

Objective: Identify the places each option would be suitable

It is important that the modelled options are suitable for the local area and can be implemented, i.e., having defined the range of possible options, it is necessary to identify which elements of the local area's energy system they are applicable to, and eliminating an option when it is not suitable. Examples of this could include:

- Ground Source Heat Pumps in domestic buildings - ensuring they are only considered an option where there is likely to be sufficient space and access to install them for that building.
- Options to electrify heat in industrial buildings – ensure you consider the grade of heat required in that building and whether it could be met electrically or if a gas is needed
- New low carbon generation - an assessment should be made of where in the local area it is possible to site it, and the total capacity that could fit in that area.

Each option should be reviewed from an engineering and practicality perspective to ensure it is only modelled where it would be possible to implement.

Objective: Model the impact of each of these measures independently, including cost, impacts on energy demand, capacity.

For each of the identified options, the modelling should assess the impact of the measures to understand costs, effect on energy demand, impact on the energy system, and any ways in which these vary (i.e., related to which part of the energy system they are deployed to, or when they are deployed). The assessment of costs should consider both the upfront capital and ongoing operational costs of the option. These assessments should be performed in a standardised way producing standardised outputs, to allow for more easier comparison later in the process of creating a LAEP. If possible, the input data used in the modelling should be taken from the data and assumptions guide that covers data considered unlikely to vary by local area (see *Annexe 2 - Standard Data Inputs and Assumptions for Local Area Energy Planning*). The approach to costing should be whole system and use HM Treasury Green Book[27] discount rates.

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

Step 4c Identify most cost-effective combination of options

Objective: Use an optimisation approach to identify the most cost-effective combination of options for each scenario that meets the defined constraints.

This objective seeks to identify, for each scenario, the combination of options that optimally meets local requirements. Each local area will have, as well as emissions reductions targets, other targets that the LAEP can help to achieve (e.g., reducing fuel poverty, creating local jobs). Some combinations of options may preclude other targets being met (e.g., the fastest route to net zero may be too expensive; the cheapest route to net zero may not create local jobs). This *optimisation* activity is therefore to assess each scenario to understand which options in combination optimally meet the targets that the local area has set within the constraints of that scenario.

In some instances, modelling tools use an in-built *optimiser* to achieve this assessment and ensure the optimal combination of options is selected. However, this isn't always necessary (i.e., it depends upon the characteristics of the local targets), and other approaches to optimisation can be taken. An optimiser typically has a single objective function which is the aspect that is sought to be minimised or maximised (i.e., minimise cost) but can also simultaneously handle a number of additional constraints (i.e., create local jobs, increase local energy production, reduce fuel poverty).

A range of approaches and tools could be used to do the optimisation. Some have sought to find the cost optimal energy system optimising across each time period, whereas others have aimed to optimise the 2050 end state and then separately identify a pathway that reaches that point. Some other approaches haven't used optimisation at all but have instead focussed on testing and comparing different scenarios. There is no single right approach to take and each has advantages and disadvantages.

A number of different tools have also been used to perform the energy system analysis and optimisation. Some are bespoke developments for LAEP, some are adaptions of existing energy system analysis frameworks, some have used commercial optimisers, whereas others have made use of open-source options.

An optimisation approach may provide more insight than a scenario-based approach, as it should find the lowest cost answer, should be able to easily consider a wider range of options, and may be more objective than an approach that has greater levels of subjectivity. However, it should be noted that it is likely to be more time consuming than a scenario-based approach, the tools required are likely to be more expensive (either in development time or licencing) and it requires more specialist skills among the delivery team. The scenario-based approach may be more affected by any subjective biases of the user, and may not find the absolute lowest cost approach, but the analysis is likely to be quicker and cheaper to do as part of the LAEP process. If adopting an optimisation approach, the greater the complexity required by the optimiser, the longer the analysis is likely to take and the more specialist the analysis tools that may be required.

Objective: Consider interactions between options during optimisation

The options selected for modelling interact with each other and so, when optimising, these interactions must be considered in a whole system manner (e.g., peak load if electrifying heat and transport). The interactions considered must at least include:

- The effect of demand reducing measures on other options that interact with that demand.
- The effect of all measures that change demand on the corresponding energy network.
- The effect of all measures that change demand on the requirement for different forms of generation.

These interactions may limit what options can be implemented together or may influence the cost of infrastructure options that are required.

Objective: The optimisation approach must ensure that all key constraints are fulfilled

The optimisation approach must meet the local area's carbon target (or get as close as reasonably possible) at the most cost-effective overall cost, whilst meeting the energy needs of the local area. However, more constraints could be identified and included in the optimisation (according to local priorities), and the potential for these should be discussed with primary stakeholders. Possible constraints that could be used include:

- Limits on costs on any one part of the system (e.g., to homeowners).
- Limits on the quantities of any one technology.
- Constraints on when and how quickly any option can be deployed.
- Impacts on air quality.
- Impacts on fuel poverty.
- Energy system resilience and security of supply (e.g., ensuring it functions after some degree of failure).

The use of additional constraints can help ensure the optimised pathway and future energy system that meets net zero goals does not lead to other issues, such as exacerbating fuel poverty issues.

Objective: Produce key outputs from the modelling to feed into the next stage

The final objective of Stage 4 is to produce outputs from modelling and optimisation of each scenario. These outputs should show what options have been selected, where and when they will be deployed, and what the overall effects on costs, emissions, and other key local variables are. These outputs are key inputs to Stage 5, where pathways are selected.

A summary of the modelling approach taken should also be documented, to provide a record and evidence of the process; feeding into the Technical Annex that is discussed in Stage 7. Table 14 summarises the main outputs that should be produced.

Table 14: Standard outputs

Outputs	At a minimum	Going Further
Buildings (no. of or m^2) and their optimal options to decarbonise at points in time.	Optimal options for buildings, with a breakdown by domestic and non-domestic, locations within the local area and when it needs to happen by.	Further detail about the specific types of buildings found to be most suitable for the options, more spatial granularity.
Energy consumption per year per time period and demand at peak times.	Total and broken down by spatial zones and categories of components (e.g., domestic buildings, non-domestic buildings, transport), split by energy vector.	Breakdown by further categories (e.g., particular types of domestic building) to a greater spatial resolution (e.g., postcode or building level where the data supports that). Data for a wider range of times during the year (e.g., characteristic days and times of day).
Carbon Emissions ($ktCO_2e$/ year) over the duration of the plan.	Emissions per time period, following the scope agreed for the LAEP. This should be broken down by category.	Breakdown by further sub-category, potentially mapping spatially across the area at an appropriate resolution.
Energy Supply	Breakdown of energy required and how it is supplied at each time period. This should identify the split between energy generated locally and energy imported into the area but does not need to identify the specific sources of generation for imported energy.	Further detail showing how the sources of energy supply change at different times of year or day. Spatial detail showing how local generation can be consumed in the area that it is produced, or the extent to which it needs exporting to other places.
Costs over time	Total system costs for each time period, also broken down by category (e.g., domestic buildings) and type of cost (e.g., capital, operational). Capital costs broken down by zone, so the level of investment required in each area is clear.	Costs presented at a higher level of detail, including a more detailed breakdown by the type of building or infrastructure they apply to. Details of the costs of individual interventions when applied at scale. Outputs showing who in the energy system different costs would fall upon (e.g., residents, network operators) without policy changes.
Transport	Identification of where transport options may have a significant impact on the local energy system (e.g., large charging hubs). Identification of possible energy requirements for private passenger vehicles.	Spatial detail of potential rollout of decarbonised transport over time, for example identifying where different types of charging options (e.g., home, public, workplace) may be most suitable. A larger scope of transport included, such as light and heavy good vehicles and public transport.
Network loads, capacities and need for reinforcement – for electrical, heat and gas.	Loads on networks over time broken down by zone over time. For electrical networks it should be split by voltage level. Identification of the amount of network build or reinforcement required in each zone.	Greater levels of spatial detail as to where the network loads and changes are required.

Stage 5.

Scenario Refinement and Selection

The purpose of Stage 5 is to assess and understand the wider impacts of scenarios produced in Stage 4, specifically focusing on factors that are of interest to stakeholders (e.g., impact on fuel poverty). The scenarios that are modelled in Stage 4 may produce extreme results (e.g., rapid roll-out of a particular technology, or reliance on a single future government policy), and therefore need to be assessed to ensure they identify future options that are suitable for the area.

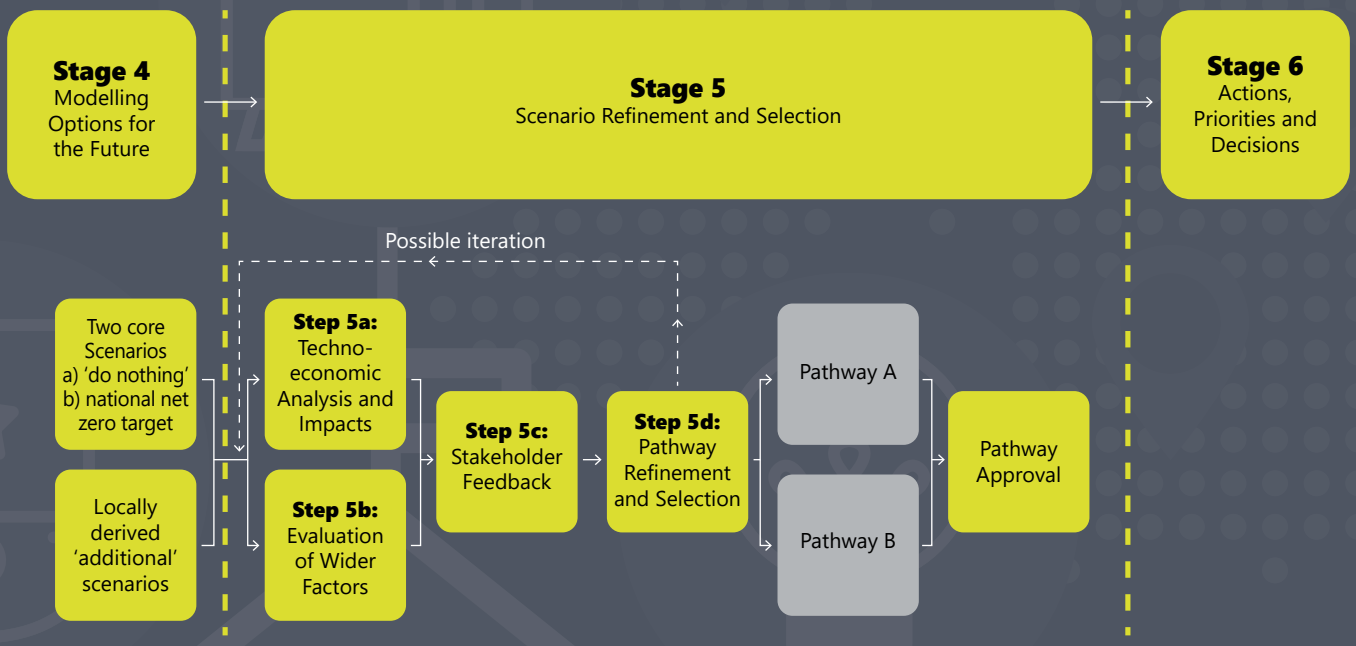


Figure 6: Steps in Stage 5, and relationships with other stages

Once the impacts of the scenarios are understood, they should be discussed with the stakeholders in order to collect their views and perspectives to inform adjustments to scenarios, selection, and the make-up of pathways that are taken forward to Stage 6. Figure 6 shows the Steps in Stage 5.

At a high-level the process for this Stage is as follows:

- Taking the scenarios and resulting outputs from the modelling and analysis undertaken in Stage 4,
- Carrying out techno-economic analysis on the scenarios and associated outputs from the modelling activity to consider technical and economic factors,
- Carrying out an evaluation of wider factors on the scenarios and associated outputs to consider other aspects, including social factors,
- Working with stakeholders, discussing outcomes and key findings to provide evidence and outputs to allow stakeholders to evaluate and identify priorities,
- Selecting from the scenarios to identify a preferred pathway (or multiple pathways; multiple pathways better accommodate future uncertainties and optionality). This may include a round of iteration, for example if a hybrid pathway taking elements from multiple scenarios would be preferential. These scenarios can then be formally approved to take forward into the plan.

A key aspect of Stage 5 is to work with stakeholders to identify the preferred pathway(s) that meet local targets. This should be done through considering the trade-offs between different aspects of the scenarios and the relationships between them. Examples might include:

- The capital investment required against the influence on fuel bills and fuel poverty. A pathway with a lower capital cost may result in higher fuel bills whereas an alternative pathway with higher capital costs may help to reduce future fuel bills,
- The ability to allow future changes to a pathway by keeping future options open whilst making progress in other areas (e.g., focus on off-gas grid areas in early years may keep open an option for use of hydrogen in on-grid areas),
- The ability to own and produce energy locally, retain money within the local area and allow the creation of a local circular economy.

Steps 5a and 5b include the analysis approaches used to understand these trade-offs and so allow choices to made between them. Steps 5c and 5d involve discussion of the analysis results and the trade-offs between different choices leading to agreeing a way forward based on a common understanding of the options and their relative merits.

The outcome of this stage is to develop the preferred pathway(s). A pathway being the proposed approach to decarbonise the area's energy system in both the short term, which should be based on a good level of certainty, and the long term, which is likely to be less certain.

Step 5a Techno-economic analysis

The various technical impacts and implications of the solutions proposed need to be analysed for key insights which are meaningful to stakeholders and to make sure they are 'sound' (both technically and economically) and to identify any barriers to deployment. These insights are based on the data outputs from modelling cost, greenhouse gas emissions, network capacity, and air quality impacts. It may be appropriate to test the robustness of these outputs to uncertainty (see *Annexe 3 - Guidance for Socio-Economic Analysis in Local Area Energy Planning*).

Objective: Compare cost and carbon savings of scenarios

To ensure consistency of approach across different LAEPs, it is recommended that HM Treasury Green Book supplementary guidance[28] on greenhouse emissions and associated carbon content assumptions are used when completing appraisal of pathway options.

Of particular use are the recommendations on how to consider and evaluate the costs, benefits, and risks of projects designed to reduce greenhouse gas emissions. This evaluation considers the appraisal of public value, based on the principles of welfare economics and overall social welfare efficiency, in addition to considerations of market efficiency and deliverability (more detail on these approaches can be found in *Annexe 3 - Guidance for Socio-Economic Analysis in Local Area Energy Planning*).

Objective: Assess deliverability of proposed solutions

Modelling may produce extreme results which are not practically achievable, such as rapid deployment of solutions at scale. An evidence-based process for judging achievable deployment rates is required so that plans remain realistic. Alternatively, it can be useful to communicate to stakeholders the scale and pace of deployment required to meet ambitious targets, to allow stakeholders to assess for themselves what is achievable. Translating the area's net zero target date into a need for training, investment and disruption allows stakeholders to make informed judgements on the optimal target date.

Collaboration with network operators can reveal alignment and differences between the pathways and the networks' investment plans (e.g., for a period of the RIIO price controls). The networks may have committed to the investment required to reach the national 2050 net zero target, whereas an earlier local target may require additional funding in excess of current RIIO allowances.

The network may be able to suggest an alternative within the current allowance or provide evidence for Ofgem that a change to the allowance would be required. There are licence re-openers built into RIIO-2 for LAEPs, so additional investment needs identified should be presented as a needs case in a form which the network and regulator can work with. A discussion with the local network operator will be required to establish what is required on a case-by-case basis.

28 https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal

Objective: Assess distribution of costs and benefits

The actors and demographics upon which costs fall and benefits accrue should be analysed (e.g., costs and benefits are likely to differ between income groups, or spatially across the local area, or between home tenure types). This can be calculated by overlaying demographic information upon the proposals of the plan and their associated costs and benefits. This also helps the local authority outline specific projects which would have the most beneficial impact on their communities.

Objective: Assess impact on bills

Changes in the way energy is consumed (e.g., due to electrification and efficiency, or connection to a heat network) should be translated into changes to typical bills (e.g., a proportionate change from today's spend), to make them meaningful to households and decision makers. Retail energy costs should be used (e.g., from Green Book projections) so that outputs are representative for bill payers, and efforts should be made to incorporate the impact of network investment on retail costs (though this could be challenging due to uncertainty around how investment costs will be socialised).

Clarity is required around the difference between direct energy system costs, versus policy costs and subsidies (e.g., electrification of heat will tend to increase heating bills, but this effect is smaller without the policy burden on electricity).

Clearly distinguishing between these components allows understanding of where the plan may be affected by policy changes (more detail on these approaches can be found in *Annexe 3 - Guidance for Socio-Economic Analysis in Local Area Energy Planning*).

Objective: Assess fuel poverty impact

Areas affected by fuel poverty and protected groups identified by the Equality Act should be considered alongside the proposed changes, to understand how these groups might be affected by the transition and to identify opportunities to alleviate pressures on these groups (e.g., the case for home efficiency improvements may be bolstered in certain areas where residents struggle to pay bills). Heat decarbonisation may need more careful management in these areas if there is a chance that it could increase bills.

> *Note:* The distributional impact of different options and their possible influences on fuel poverty levels should be analysed and understood as part of assessing scenarios and developing pathways. However, the LAEP process does not attempt to solve the wider problem of how a fair and equitable transition can be delivered for all citizens. Once the preferred local pathway has been developed, policy work may be required to enable this.

Objective: Express investment in per-household terms

Investment should also be expressed in *per-household terms*, by separating the investment in domestic solutions from the total costs (e.g., building energy-efficiency, heating systems, EV chargers and solar PV) and dividing this by number of households. It may also be valuable to present investment for a range of housing archetypes (e.g., 3-bed semi-detached house with heat pump and EV charger) to better understand how the investments will need to be distributed.

Objective: Analyse network capacity requirements

Modelling is likely to highlight areas where large changes in network capacity requirements will be required. Most notably increases in required electrical distribution capacity, but also creation or expansion of heat or hydrogen networks, conversion of gas networks to hydrogen distribution and decreases in gas distribution capacity. Where large electrical capacity increases are needed, this could point to focus areas for alternatives to conventional capacity investment, such as demand-side flexibility, and storage. It also highlights the need for early engagement with networks and planning for upgrades to ensure that the capacity constraint doesn't become an obstacle to the progress of the plan. Examining present-day capacity headroom can also highlight areas where early progress can be made, deploying solutions such as heat pumps and EV chargers without network constraints posing an immediate obstacle.

To do this effectively, an understanding of where and why the network upgrades have been proposed is required. This will be due to an increase in demand (or generation) that the current infrastructure cannot support. An assessment of the times of the day and year where this increased capacity is required, and if it is something which is across the year or only at particular times is required. From this, the question of whether network upgrade requirements can be mitigated using flexibility can be considered. The options for flexibility and their relative costs compared to network upgrades should be considered in conjunction with the network operators.

Objective: Assess system resilience/security of supply impacts

Solutions must avoid reducing security of energy supply, by working with networks to understand these requirements.

- 1-in-20 years peak day demand as used for gas network design, and
- N-1 design criteria for electricity network design (this means that all loads can be restored if any single component fails and that in the restored condition appropriate signal conditions, such as voltage levels, are still met).

Given normal circumstances, it can be assumed that the distribution network infrastructure would provide this, but when flexibility is added to the mix this needs to be critically assessed. If there is a single battery which is providing network support in the short term, it is essential to know at what point that could fail and how that would impact those connected to that network branch.

Objective: Provide information on risk and complexity of proposed solutions

Certain pathways may involve greater or lesser dependencies on unknowns (e.g., immature technologies or policy speculation, behaviour change), or be more or less socially contentious, or be difficult to attract finance for. Most pathways are likely to depend on a rapid development of skills and supply chains, but these may shift between different industries or vary in scale between pathways.

The risks associated with the different solutions and pathways should be explained (e.g., unintended consequences of particular solutions). A case in point is residential retrofit. While this is commonly expected to play a major role in decarbonising heat, the business models are not currently attractive enough to investors for them to play a major role in supporting. Building fabric also has constraints on delivery due to a lack of trained personnel to deliver the solutions.

Step 5b Evaluation of wider factors

Although decarbonisation is the primary motivation behind LAEP, other important social factors are affected by the design and performance of the energy system. An understanding and analysis of social, economic, supply chain and environmental factors which will influence the evaluation of options is needed. These factors may be in tension with the search for a low-cost solution to the decarbonisation problem. If an understanding of these wider non-technical factors is not reflected in the plan with actions to address them, then the plan will be incomplete and less likely to be successfully implemented. Appropriate analysis allows the wider social factors to be properly considered when making energy system choices and identifying the proposal that delivers best social value to society, whilst also identifying potential barriers to deployment. The results of this analysis and its influence on the pathway choices made should be documented alongside conditions for success that need to be put in place over time to secure the required societal and energy system change. It may be appropriate to test how the results of this analysis are influenced by uncertainty (see *Annexe 3 - Guidance for Socio-Economic Analysis in Local Area Energy Planning*).

The appraisal approach employed for considering distributional effects should be proportionate to the likely consequences for those affected. Some of the impacts can be monetised using an economic appraisal, described in the Green Book as focusing on social value from the perspective of society and considering all social, economic, environmental costs and all effects on public welfare. For some others there is clear evidence that a benefit occurs but insufficient evidence to attempt to apply a monetary value. In line with the Green Book, these unmonetisable benefits should be included in assessments where there is evidence of their impact. The most appropriate approach for evaluation of a particular benefit could be dependent on the local situation as well as the scale of the particular projects being assessed and the data available locally, amongst other factors.

For a more detailed discussion of the Green Book, suggestions as to which social factors should be assessed and approaches that can be used for their numerical evaluation, please refer to the supplementary *Annexe 3 - Guidance for Socio-Economic Analysis in Local Area Energy Planning*.

Objective: Carry out (socio)economic assessments

Some non-technical factors can be monetised and included in economic analysis (which may occur outside energy system modelling), such as social and environmental cost/value. Examples include:

- **Energy and carbon savings:** Energy efficiency has a direct social value as the energy saved itself has a direct benefit to society. In addition, GHG emissions reductions can be valued in monetary terms.
- **Employment creation:** By analysing the quantity and timeframe of recommendations and associated investments, estimates can be made around the number of skilled workers required to deliver the changes, giving an indication of the job creation benefit to the local area.
- **Health benefits:** These can result from a reduction in air pollution due to transport and heat electrification, an increase in exercise due to active transport and warmer homes due to improved building efficiency. Local authorities are mandated to support their communities, and thus this metric will help them prioritise areas and projects.
- **Comfort taking:** This is the proportion of energy saved which householders retain and utilise in order to increase the level of warmth in their homes

Objective: Carry out comprehensive assessment of unmonetisable wider factors

This could be a multi-criteria analysis based on key metrics of interest agreed with stakeholders to provide an understanding of the impacts and implications of the proposed solutions beyond cost and carbon, such as the various social impacts. Factors can include impacts, risks, co-benefits and opportunities in skills and supply chains, public and consumer perceptions and preferences, national policy, regulations, market conditions and funding decisions. Examples of possible analysis tools include:

- Multi-criteria decision analysis
- Robust decision making
- Iterative risk management
- Weighted matrix
- PESTLE (Political, Economic, Social, Technological, Legal, Environmental) analysis
- "Walking right round the issues" approach (Figure 7, and https://www.cse.org.uk/downloads/file/west-of-england-energy-study-report-and-recommendations.pdf *pp*14 for an example of its usage)
- Diagramming techniques such as multiple cause diagrams, influence diagrams or participatory systems mapping

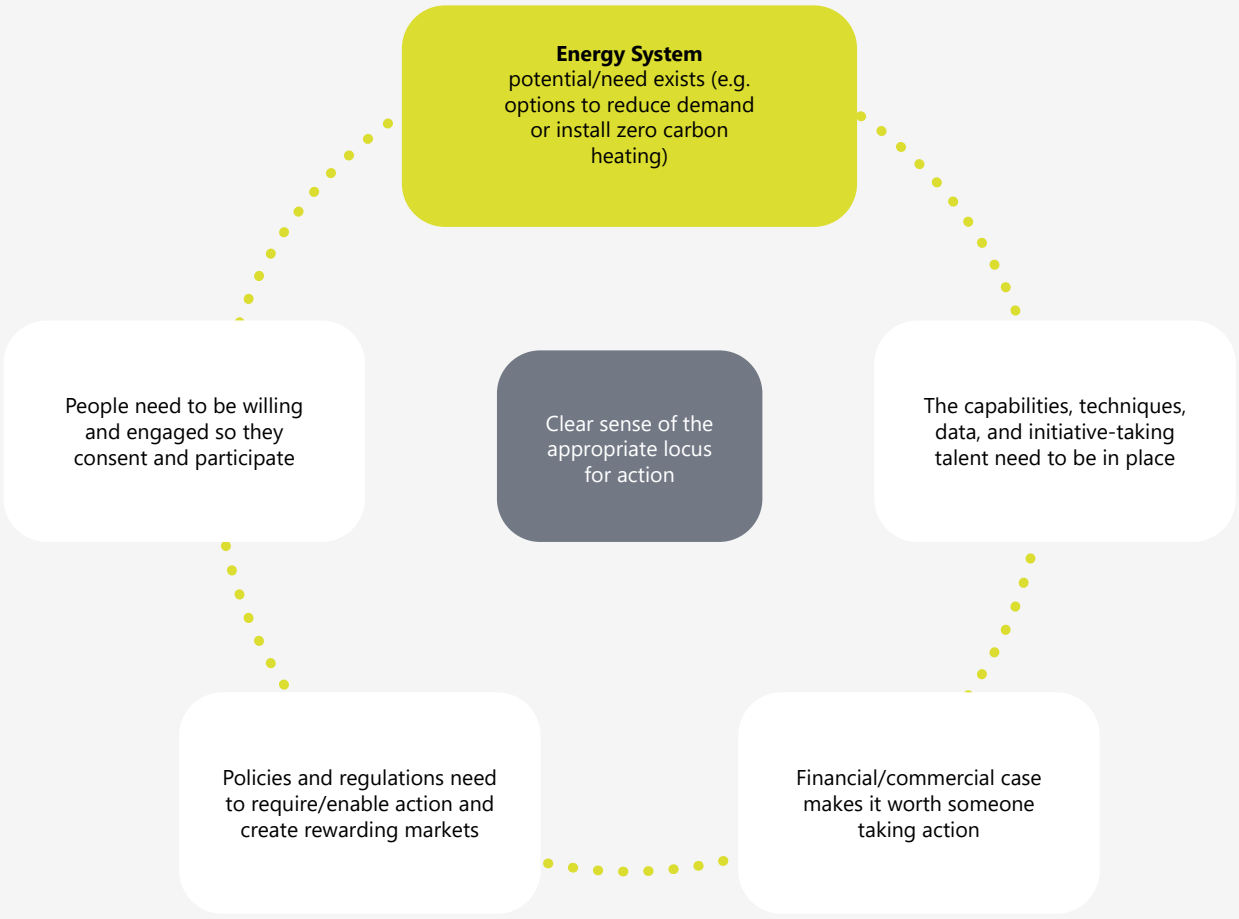


Figure 7: "Walking Right Around the Issues" approach, Centre for Sustainable Energy

Objective: Identify critical success factors which need to be addressed to secure change

Describe the conditions for success for each of the wider factors that need to be put in place to secure the required societal and energy system changes at the scale and pace required, and the present-day state of these factors. Determine how the rate of implementation of solutions would be influenced by these factors (i.e., the risk to the plan), and how this is reflected in the pathways. These critical success factors will inform the enabling actions identified in Step 6b.

For example, it is likely that a mixture of government subsidy and private finance will be required for domestic energy efficiency retrofit to cover the likely costs per dwelling, and a sustained and multi-year programme by government will most likely be necessary. This is something which is not under a local authority's control, and thus is an 'enabling action' (see Stage 6), requiring months or years of preparatory work to support the implementation.

Objective: Quantify the supply chain and skills requirements

The changes recommended are likely to involve installation of equipment at a faster pace than has historically occurred, requiring larger scale procurement and a greater number of skilled tradespeople to design and carry out the works to a good standard. Knowledge and skills which are currently uncommon will be required for new types of systems and products which are currently produced and sold in low volumes, and which may need to scale up rapidly. By analysing the quantity and timeframe of recommendations, consideration can be made around the supply chain and training requirements.

Objective: Assess disruption

Disruption may be due to internal modifications to homes, or due to road works related to changing or building energy networks.

Objective: Consider regional influences

Regional changes or opportunities may influence local decisions. These could include local network operators' existing plans such as for production and distribution of low carbon hydrogen or reinforcement of electricity networks and procurement of flexibility services.

Objective: Understand public attitudes and preferences

Consumer choices can have a significant impact on the ease of roll out of particular solutions (e.g., it can be hard to displace incumbent solutions if alternatives are perceived to be more expensive or to offer no benefits). Engaging local citizens to understand attitudes and preferences can help to ensure the chosen solutions are acceptable, or to understand where additional work is required to explain benefits.

Step 5c Stakeholder engagement: pathways review and refinement

This Step is the process of communicating the findings of the scenario assessments to the stakeholders, allowing them to express preference for certain scenarios, components or aspects of particular scenarios (e.g., fuel poverty may be a top concern for a local authority, while they may not have air quality issues; such preferences can help steer refinement).

Results of the analysis of both the techno-economic and wider benefits analyses should be presented in a consistent way so that different options can be readily compared, and the relative benefits and issues understood. It could be that stakeholder priorities have been captured at an earlier stage of engagement, such as when agreeing the scenarios in Stage 4. However, it is likely that this will be an iterative process as stakeholders bring forward fresh knowledge or ask about aspects of options that cannot be readily explored using previously prepared analyses; in addition, outputs/evidence provided to stakeholders at this stage may result in a change to previous preferences.

In the case of unmonetisable benefits it might be useful to hold workshops with stakeholders to explore options using some of the techniques proposed in Step 5b.

In all cases a record should be kept of the opinions expressed and the reasons behind the choices and trade-offs being made.

The process and resulting pathways should result in common ground being found between stakeholder preferences (which are expected to be reflected in the scenarios and optioneering agreed in Stage 4); based on a credible and evidence-based process.

Step 5d Primary stakeholder engagement: pathways selection

As stakeholders have an opportunity to review pathways options and express their preferences, some scenarios (or aspects and components of particular scenarios) are likely to emerge as more favourable to the stakeholder group. Scenarios can then be down selected to a main pathway or set of pathways which will be the focus of the plan. They may combine features from several of the initial scenarios to form hybrids.

The types of trade-offs that might be made in Step 5d are:

- Higher levels of local renewable generation than is cost optimal in order to allow decarbonisation of emissions from electricity consumption at a faster rate than that expected from the national grid or provide a benefit locally,
- Higher levels of fabric retrofit than is cost optimal due to the positive influence on fuel poverty and wider health benefits associated with warmer homes.
- A focus on electric heat solutions in preference to use of hydrogen for heat in order to achieve faster decarbonisation (e.g., if hydrogen is not planned to be delivered to an area within a certain timeframe)
- Construction of a local heat network connected to local public buildings and social housing as this project can be instigated and managed by the local authority independently
- Assessing the advantages and disadvantages of decarbonising the local area ahead of the national net zero target; considering for example how implementation could be funded and achieved ahead of national market, policy, and regulation mechanisms

Going Beyond the Requirements - iterative modelling to accommodate preferences

As the impacts and implications of the range of scenarios emerge, an iterative process of stakeholder review and feedback allows the pathways to be tailored to capture their views and preferences. In terms of emissions, as the changes and rate of changes required to meet the net zero target date emerge, along with the associated costs, the stakeholders may wish to explore increased or relaxed ambition levels, depending on their views on what is achievable. There may be a need to revise the pathways for different target dates to give a sense of options. Ideally, any revised pathways would be subject to the same evaluation process as the initial pathways to ensure that they achieve the anticipated outcomes.

In addition, stakeholders may identify specific favourable components from the scenarios assessed, that may highlight the requirement to develop a new hybrid scenario.

NOTE: While targets can be adjusted through iteration, the number of iterations would be limited due to project specific factors such as time and cost.

Stage 6.

Actions, Priorities and Decisions

The purpose of Stage 6 is to assess the pathway(s) chosen in Stage 5, and to categorise their components based around how soon they can be delivered (Figure 8). Components that are more certain and subject to fewer or less onerous barriers are categorised as near-term, whereas more uncertain components, or components that face significant barriers to their implementation are categorised as long-term. Within each of the categories of near and long term, components are further categorised:

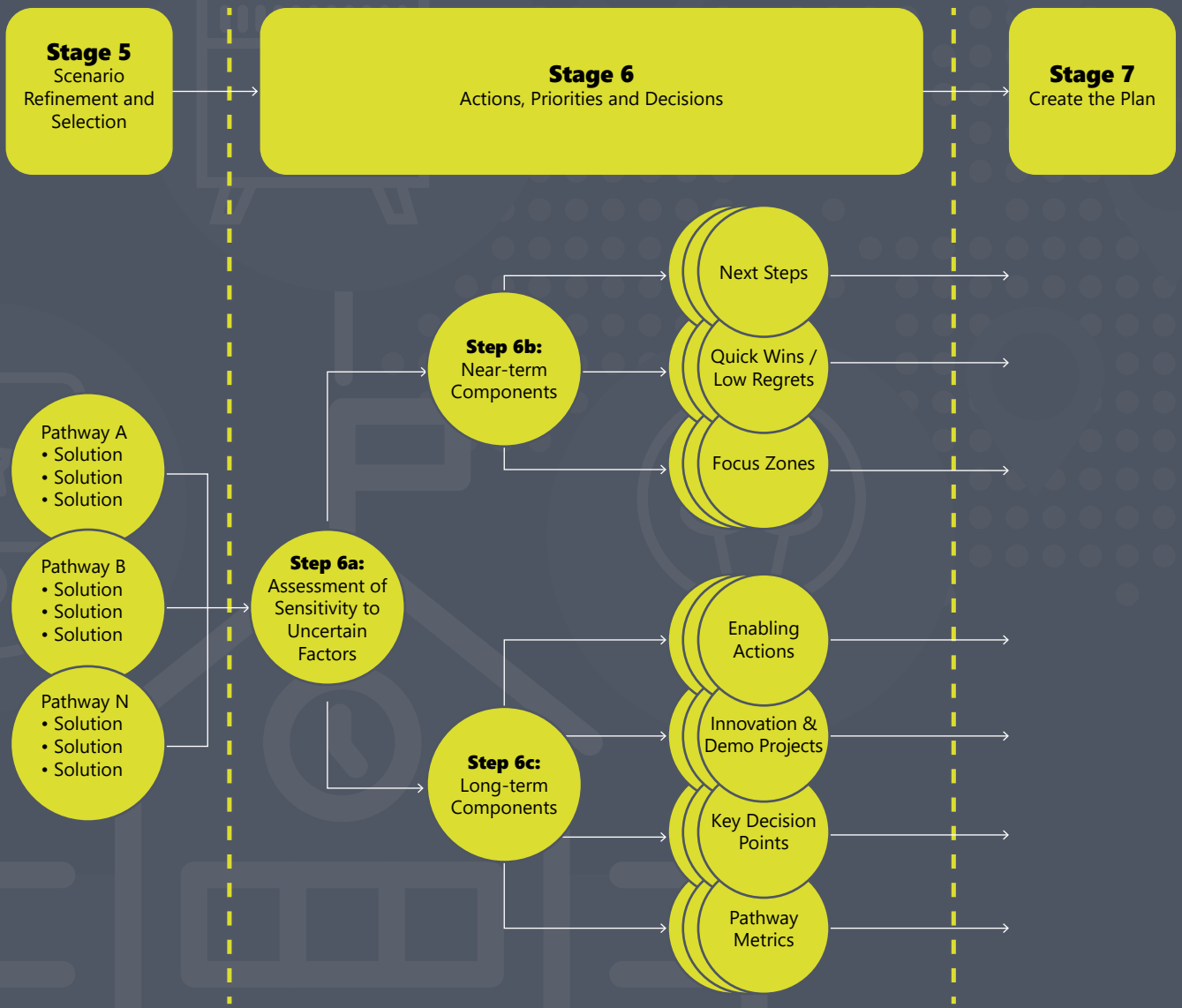


Figure 8: Steps in Stage 6, and relationships with other stages

Near-term components:

- "Quick wins" which can be carried out in the near-term without major blockers.
- "Low regrets" projects which are common under various scenarios but may require further enabling action before they can be progressed.

Long-term components:

- "Enabling actions" which need to be carried out ahead of time to pave the way for later solutions,
- "Decision points" where the most appropriate solution is chosen at some point in the future once more information is known. These decision points may be needed before widespread scale-up and deployment of solutions.

During the process of considering these near-term and long-term components:

- if near-term components cluster in a particular 'zone' within the local area (zones are described further in Step 6b), that zone can be marked as a 'focus zone'.
- for near-term components, identify next steps that will enable progress.
- for long-term components, identify any specific innovation and demonstration projects required ahead of a "decision point"

The outcomes from this process form a key part of the LAEP, detailing how the area intends to meet the emissions target. Stage 6 uses information from Stage 4 and Stage 5 to define projections and metrics to track delivery of the pathway (e.g., such as installation of low carbon heating systems, and other delivery activities such as tracking progress on decision points). Figure 9 shows the inter-related components and relationships with the timeframe to net zero

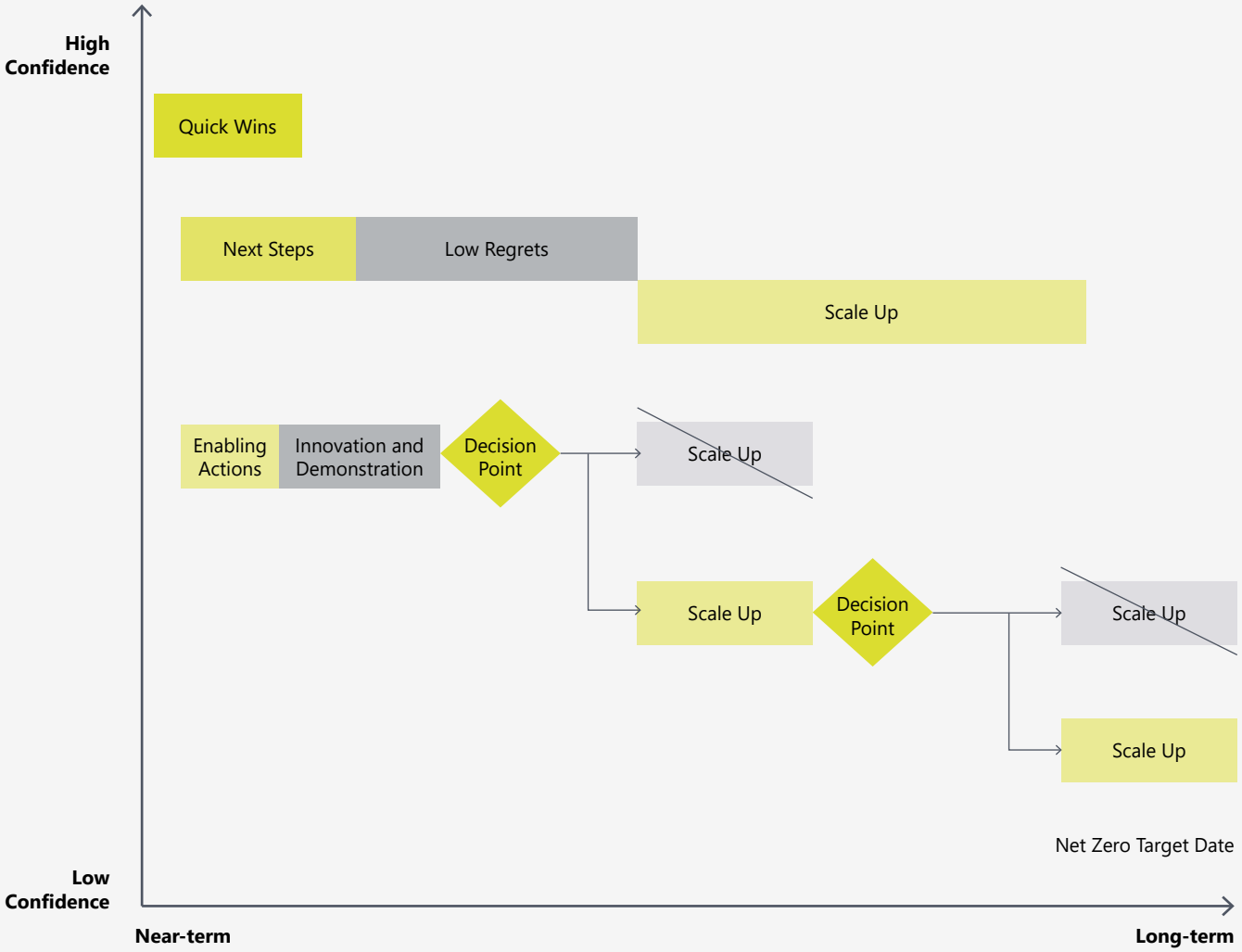


Figure 9: Breaking down a pathway into timed actions

Examples of specific actions that could be relevant to the parts of this diagram are shown in Figure 10 (note that a full plan would be *far more expansive* in the number and reach of actions than shown here) For clarification, the hydrogen strategy may be relevant to several house types, but terrace homes (in this example) may be waiting for the announcement on hydrogen before they are decarbonised).

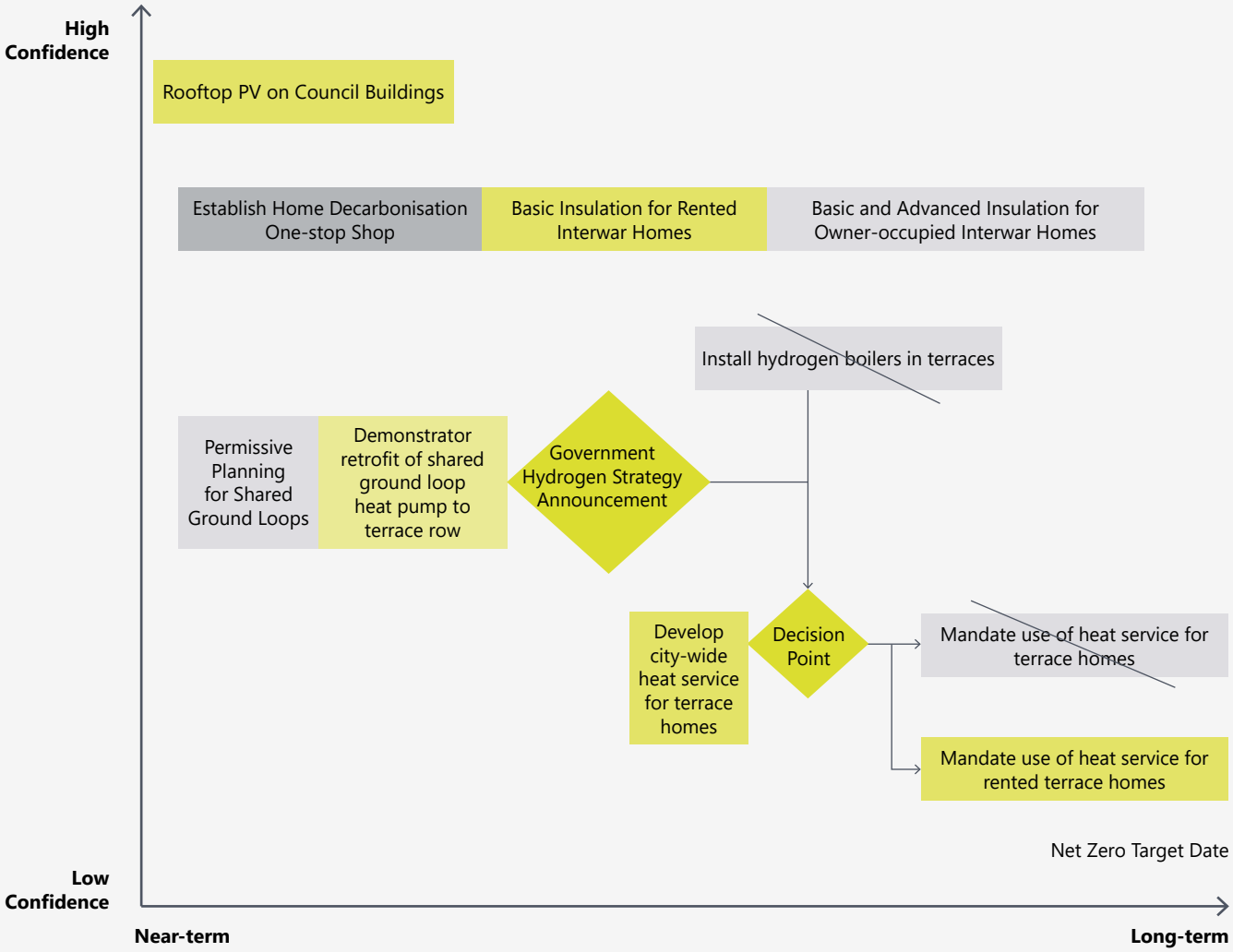


Figure 10: Example of a pathway breakdown

All of the above terms are described further in the following objectives.

Step 6a Assess sensitivity to uncertainties

Objective: Identify the main similarities and key variances between scenarios

The assessment of scenarios in Stage 5 may have produced more than one possible pathway for the LAEP. Multiple pathways allow room to adapt to unknown factors both within and outside of the local area's control, such as supply chain capacity or developments in national hydrogen strategy.

Highlighting the key similarities and differences between scenarios helps to illustrate which interventions are most affected by uncertainty, and where low-regrets actions can be taken, which will be suitable regardless of uncertain factors. These low-regret interventions will typically appear in most, if not all scenarios, and are therefore likely to be robust to any future change. Understanding the drivers of the variations between pathways makes it possible to plan for future developments (through identifying the key decisions points in the pathway), switching to the most suitable pathways as circumstances change.

Once these main factors are identified at a high level, they can then be broken down in further detail through the following Steps.

Step 6b Near-term components

Interventions that are sequenced for the early stages of the pathway can be categorised as 'near term' (3-5 years), based on factors such as being suitable across a range of scenarios (low regrets), using well-established technologies and having few obstacles to implementation (quick wins). If near-term components are focussed in a particular area, this can be designated as a 'focus zone'. Near-term components should also fit with the longer-term direction of the plan, avoiding any interventions with short-term benefits that compromise long-term components.

Objective: Identify 'quick wins' project opportunities

Project opportunities categorised as "quick wins" can be carried out in the near-term without major blockers. Examples include:

- Building energy efficiency retrofit, such as cavity wall, loft insulation, and glazing upgrades.
- EV charge points for domestic properties with off-street parking.
- Replacing oil fired boilers with electric heating systems
- Installation of solar PV on suitable public buildings and social housing
- Improving heating control systems

Objective: Identify 'low-regrets' project opportunities

Project opportunities categorised as "low regrets" are common under various scenarios but may require further enabling action before they can be progressed. Examples include:

- Heat networks in densely populated areas of pre-1920's terrace housing
- Rapid EV charge points at service stations and public car parks
- Electrification of heating systems in areas off the gas grid
- Extending a district heating network to residential areas in an area/zone where there is evidence that this would be preferential over other heating options

Objective: Identify Focus Zones

Focus Zones are specific areas within the LAEP boundary that have a cluster of near-term components (e.g., an area might be marked as a focus zone for building energy efficiency retrofits due to high numbers of a particular type of housing, or a focus zone for EV charging due to spare electrical capacity in the network and a large number of homes with off-street parking, or a combination of multiple solutions).

Zone identification should be agreed with the primary stakeholders, establishing the priorities for determining their characteristics. Zones can be used to both:

- Break down and visualise the proposed implementation of the LAEP at a more locally representative scale, for example, through highlighting the proposed energy system change and investment etc. for specific places within the LAEP area.
- Highlight where specific solutions and/or prioritised actions and projects are proposed so that organisations involved with the delivery of the LAEP can relate activity to place.

These zones do not have to be at the level of the 'modelling'; they can pinpoint areas at the scale most valuable for stakeholders (e.g., at a neighbourhood level). This recognises that more detailed work (e.g., feasibility and design/ development work) would be required after the LAEP has been produced to move forwards.

Further information describing the type of energy system detail that can be broken down and visualised at a more granular zonal level is provided in Stage 7 (e.g., illustrating costs and investment, emission reductions, energy demand impacts, network Infrastructure impacts, and proposed installation of energy system components by category.

The socio-economic factors relevant to the activity proposed for these zones should be understood (e.g., building efficiency upgrades for fuel-poor households[29]).

A variety of techniques could be used to identify these zones:

- based on housing types where particular solutions are likely to be prevalent,
- areas off the gas grid where there is more certainty on heating system choices since hydrogen is unlikely to be an option,
- focus on areas with particular types of tenancy such as social housing or housing in multiple occupation,
- areas where network capacity is available to allow electrification of heat or installation of renewable generation,
- links into existing community energy schemes,
- concentrations of publicly owned buildings which can be used to drive change such as take-up of a heat network or to demonstrate fabric retrofit approaches or to share other energy assets such as generation or storage,
- areas with particular challenges such as poor air quality, high levels of fuel poverty or significant social deprivation,
- highlighting hydrogen opportunity areas where there is supporting evidence to initiate a hydrogen supply in an area
- identifying heat network focus zones where there is supporting evidence that this would be a presential heating solution for an area

It is likely that overlaying a combination of factors like these will help with identification of zones.

29 For more detail on evaluation of socio-economic factors please refer to the supplementary Annexe 3 - Guidance for Socio-Economic Analysis in Local Area Energy Planning.

Step 6c Long-term components

Long-term components are those that are more uncertain, not consistent across multiple scenarios, or have significant barriers to implementation. Acknowledgement of these components as being long-term is an important aspect of LAEP. Examples include:

- An area within the LAEP that in some scenarios has domestic properties switching to heat pumps, whilst in other scenarios has the same properties switching to a heat network (inconsistency across scenarios, uncertainty).
- An area within the LAEP that could switch to hydrogen as a fuel source for heating, once a national decision on hydrogen is made (significant barrier, uncertainty).

Whilst implementing the near-term components, the uncertainty and barriers that are preventing long-term components being implemented can be worked on, bringing them into the near-term for future LAEPs.

Objective: Outline and timetable projections for long-term components

Produce a timetable outlining the proposed long-term scale-up of solutions required to meet the target, showing key decision points over time, and early enabling actions required to stay on track.

There are three types of factors affecting long-term components:

- Enabling actions - may have long lead times to remove barriers to projects, such as changes to planning policy or network reinforcements, so may require near-term action to help facilitate long-term change. They should include actions needed from wider stakeholders (e.g., government or regulators) and how the locality will influence such stakeholders to take these actions to support local efforts.
- Innovation and demonstration projects - can bring longer-term solutions into the near-term to produce learning, familiarity, and confidence ahead of scale-up. Innovation funding may be available to support these types of projects while market conditions are not yet supportive.
- Key decision points - could be based around national policy, technology or economic developments, public opinion, and can indicate the assumed latest point in time at which a decision should be made to stay on track, as well as outlining the information which is needed to make the decision.

Step 6d Prepare for implementation

Objective: Sequence the deployment of interventions to build pathways, and understand the rate of delivery

Interventions must be sequenced and built up into a pathway. Pathways require the timing of the interventions and the interactions between the interventions to be considered and assessed, recognising that taking a whole systems approach will likely bring efficiencies (e.g., installation of EV chargers could trigger the need for infrastructure upgrades, which could at the same time futureproof the system for heat electrification avoiding the need for further upgrade works). Sequencing interventions must cover both near-term and long-term components, and include both tangible activities (e.g., installing EV chargers) and less-tangible activities (e.g., making progress with decisions points).

As well as technical factors affecting sequencing, sequenced interventions need to account for:

- Meeting emissions reductions targets
- Political and budgetary cycles
- End of life replacement of technologies
- Network operator price control points
- Minimising disruption
- Meeting local, regional, and national policy targets

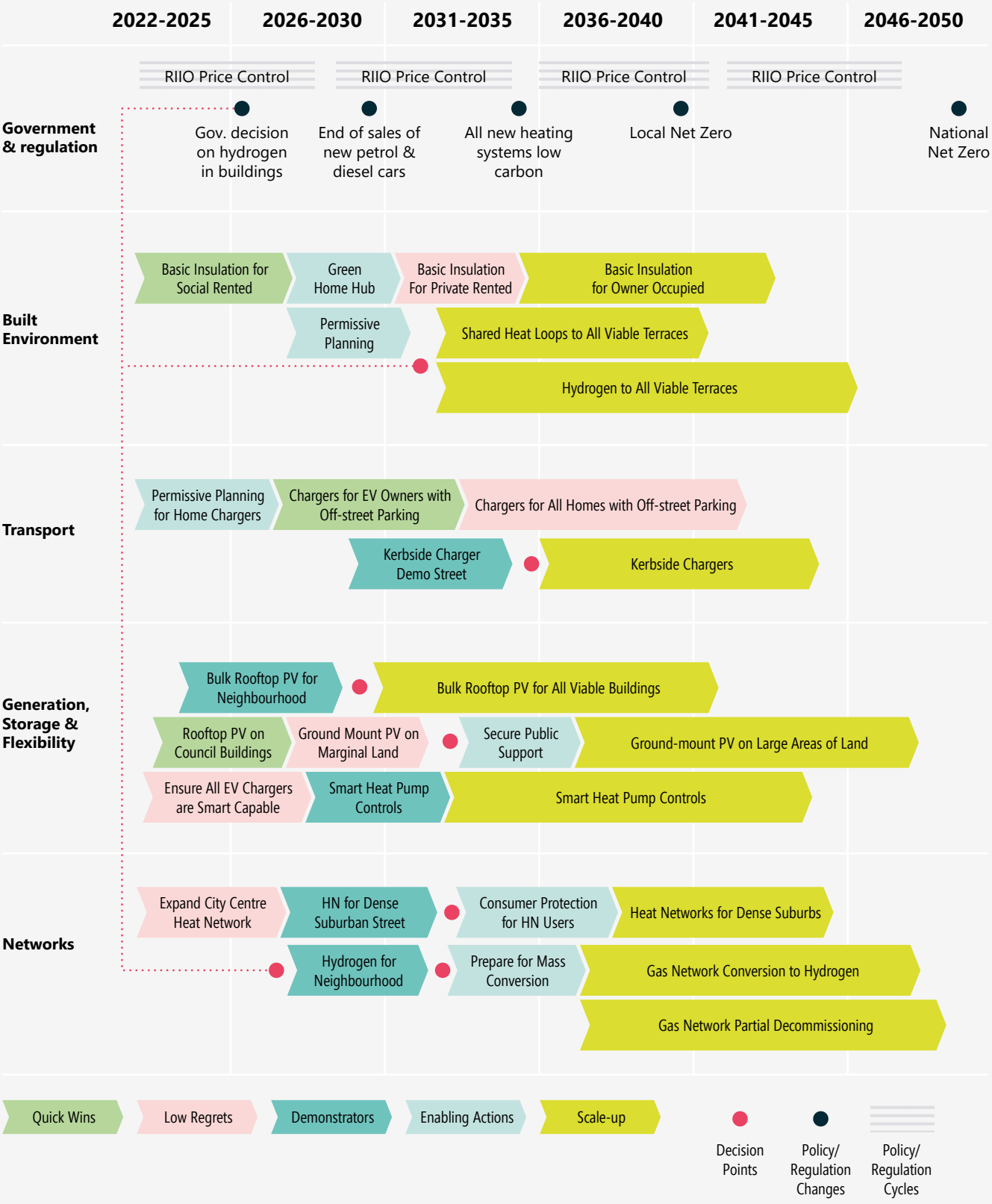
A key component of sequencing deployment of interventions is assessing the rate at which they can be deployed. Deployment of physical interventions such as EV chargers, building energy efficiency fabric retrofit measures, renewable energy technologies, and new heating systems will have a rate at which they can be rolled out.

Recognising these constraints needs to be factored into the sequencing. Considerations could include:

- Meeting emissions reductions targets
- The ability of the supply chain to meet demand
- The skills, training, and experience of installers
- Development of new infrastructure or energy vectors (e.g., heat networks, hydrogen) that prevent roll out from starting until a later date
- New technologies and innovations
- Alignment with other local plans such as for transport or development.

A mock-up timeline is shown in Figure 11 to provide examples of the type of information required (note that the timelines for full plans would contain much more content).

Figure 11: Example timeline



Objective: Establish projections for delivery

Building on the sequenced pathway and recognition of deployment rates, projections for delivery can be established and progress tracked. Such a tracker can assist the lead organisation to understand how achievable targets are, how well they are making progress, and whether any further actions are required to ensure delivery.

This could be a simple table that tracks each intervention, the number required to be installed per month / year / or other time-period according to the plan, and progress made to date.

Objective: Highlight impact of the LAEP on energy networks

Deploying interventions will have an impact on the energy networks that can now be assessed in light of a sequenced plan and deployment rates. Network operators are primary stakeholders in a LAEP, so will likely have been involved in the sequencing plan, but if they have not then this is an important step for their inclusion.

The analysis should consider gas, electricity and, where appropriate, heat networks. It should provide indications on where and when work on energy networks is likely to be required and the indicative costs of these works. For areas where flexibility has been identified as an alternative to reinforcement, this should be highlighted.

Expectations of network capacity and investment requirements should be both near and long term. In the near term, limited network capacity may prevent or delay implementing interventions, whereas long-term the focus will be on planning and sequencing investments ahead of demand changes.

If these projects are likely to require network operators to perform enabling work, then it is essential that these are clearly communicated. Furthermore, if investment is required within the operator's current RIIO price control period then use of the licence re-openers built into RIIO might be required to unlock the capital required. In all cases there will be a need to work closely with the operator to establish their investment options and timelines to complete required works. Finalising the exact details of any required works is not in the scope of a LAEP as it will depend on detailed design work conducted as projects are developed in more detail.

Step 6e Establish priority projects

Objective: Establish pipeline of specific outline priority projects

When identifying the near-term and long-term components, a selection of these should be identified as specific outline priority projects. These can be 'quick wins' or 'low regrets' (near-term) or innovation and demonstration projects (long-term). This pipeline will require updating as projects initially not categorised as being a priority become a priority. The purpose of identifying specific outline priority projects is to provide the local area with projects that can immediately be implemented to make progress towards net zero.

A wide variety of interventions could be selected as priority projects. Near-term examples could include:

- Targeted retrofitting of social housing, including fabric retrofit and / or switching to low carbon heating systems, projects targeting off-gas grid properties
- Setting up an energy advisory service for local businesses and residents.
- Installing public EV charge points on council owned land or working with local businesses to increase charge point installations.
- Progressing development or expansion of local heat networks.
- Decarbonisation of public buildings.
- Identifying areas where limited or poor data has been detrimental in the LAEP process and developing a plan to gather improved information prior to the plan's next refresh.

Innovation and demonstration projects could include:

- Testing methods to overcome barriers to connection of privately owned housing to a local district heat network,
- Development and trialling of a local energy market,
- Development and testing of a smart local energy system,
- Developing and testing compelling customer propositions for low carbon heating
- Developing and testing ways to use existing council services to engage with local residents to support and encourage uptake of low carbon solutions.

Objective: Highlight opportunities for public and private investment for the outline priority projects

Many of the proposed solutions will require private investment or point to new markets and demands where business opportunities are likely to emerge. Highlighting these opportunities and providing additional details - so that further work can be done post LAEP to support investment appeal - will enable local government as well as private investors and businesses to implement the plan.

Standard metrics to describe key project attributes are required to allow projects to be aggregated and assessed at scale in a consistent way. Projects should outline, at a high-level, the proposed technology, alongside high-level costs, and impacts. It is not expected that the LAEP will include fully developed business cases, but it should identify areas where further work should be undertaken to develop them for particular interventions.

Objective: Highlight projects within local authority's influence

When identifying outline priority projects, those that local government can influence should be highlighted. Local authorities typically have responsibility for:

- Buildings that they own and operate, such as council offices, leisure facilities, and schools.
- Buildings that they own but do not operate, such as council housing and commercial premises.
- Vehicles, such as refuse collection lorries and commercial vans.

An understanding of the powers and limitations that the local authority has, as well as an understanding of their appetite for responsibility and risk is necessary to understand barriers to implementation. Collaboration with stakeholders may accelerate implementation or remove barriers.

It should be noted that different levels of government are best placed to design and deliver particular interventions. The principle of 'subsidiarity'[30] should apply where responsibility to act is devolved to the level where decisions can be taken most effectively.

Objective: Engagement with stakeholders

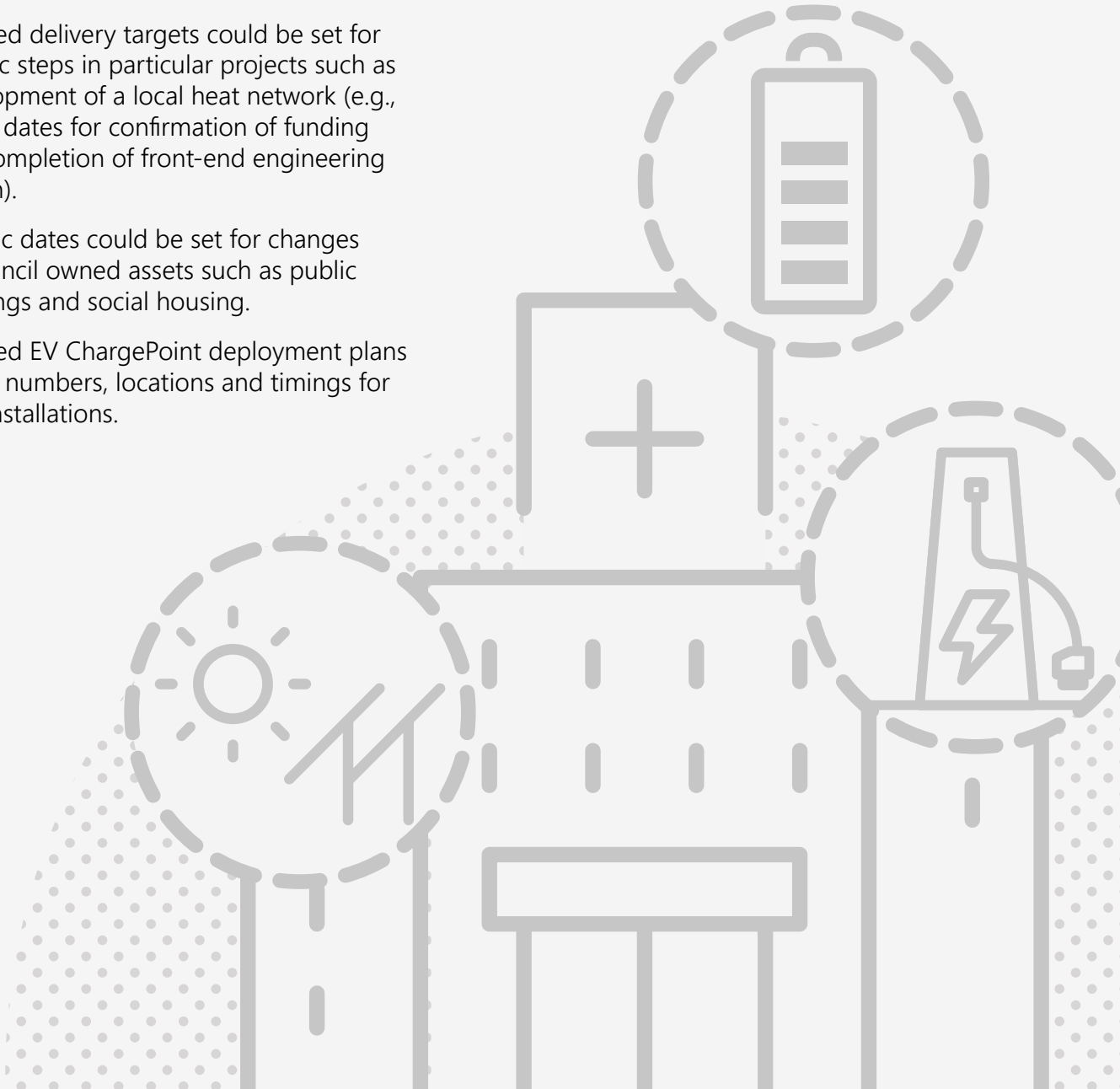
Aspects of priority projects not within direct control of the local authority will require engagement with stakeholders. Stakeholders, such as private householders or businesses in the area, will need to be involved in order for the projects to be delivered. The extent of this engagement will be determined by the project characteristics, such as timescales and funding.

30 (in politics) the principle that a central authority should have a subsidiary function, performing only those tasks that cannot be performed at a more local level

Going Beyond the Requirements

Whilst it is recommended that all LAEPs contain a set of targets for delivery (i.e., the Objective: Establish projections for delivery in Step 6d) to allow monitoring of progress and to communicate the requirements expected on supply chains, funding sources, behavioural change, governance, and every other element of delivery, local areas may choose to be more specific in the level of detail provided. For instance:

- Heating system upgrade delivery targets may be broken down by housing types, districts, or tenure.
- Specific dates could be set for completion of identified actions such as quick wins, low regrets projects or enabling actions.
- Detailed delivery targets could be set for specific steps in particular projects such as development of a local heat network (e.g., target dates for confirmation of funding and completion of front-end engineering design).
- Specific dates could be set for changes to council owned assets such as public buildings and social housing.
- Detailed EV ChargePoint deployment plans giving numbers, locations and timings for new installations.



Stage 7.
Create the Plan

The purpose of Stage 7 is to create the LAEP (Figure 12). Stage 7 brings all of the work carried out during the preceding stages into a single document that is the plan to be carried forward for the local area. Creating the LAEP document can commence at any time throughout the process once content is ready. When Stage 7 is complete, the LAEP can be implemented.

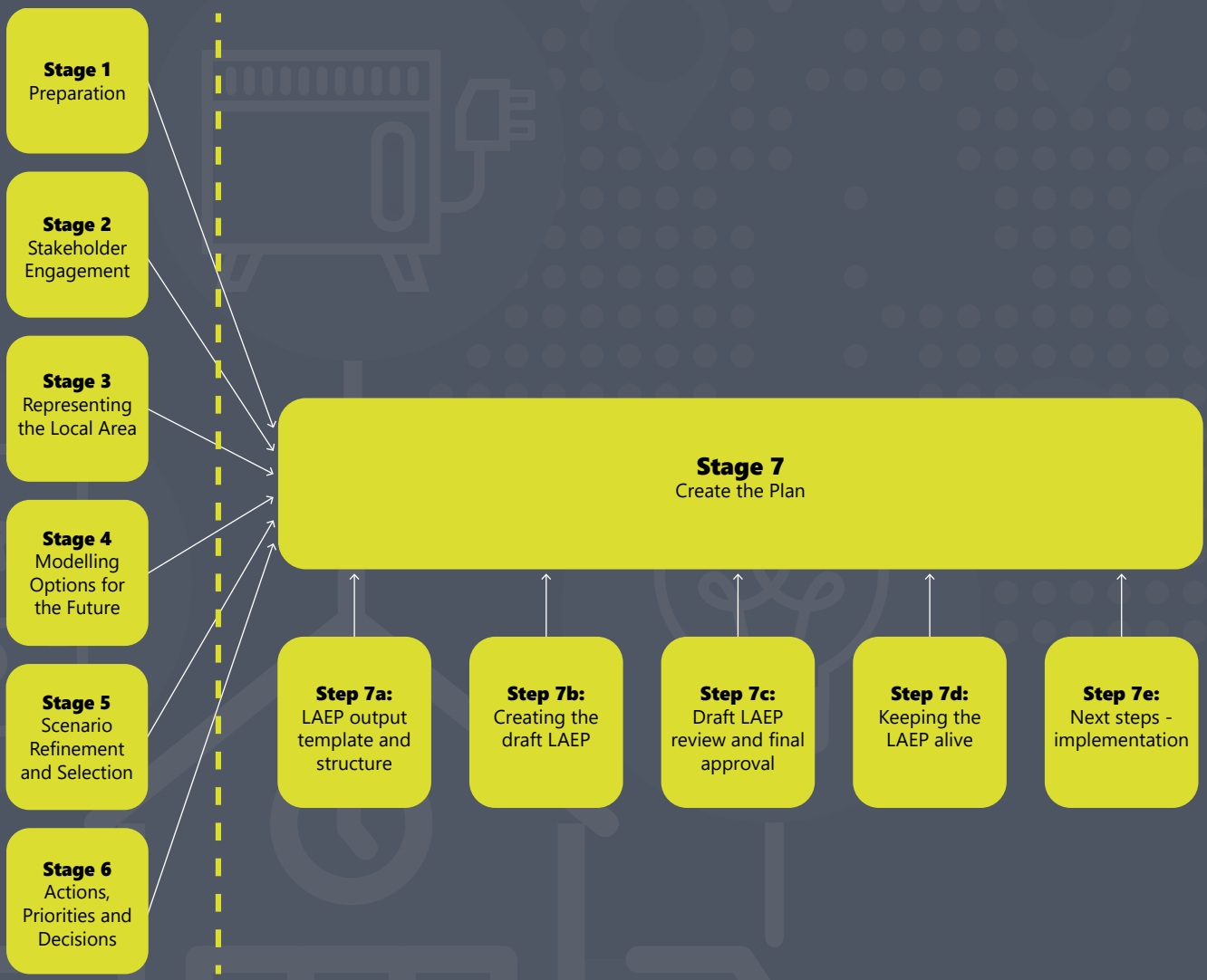


Figure 12: Stage 7 and relationships with other stages

Step 7a LAEP output template and structure

To ensure LAEPs are consistent, in terms of their structure and content, a standardised template should be used. Consistency between plans across regions and nations allows plans to be compared and consolidated, creating a picture of progress to net zero across larger geographical scales. This is potentially of interest to national governments for a better picture of policy and funding requirements, the supply chain for understanding and mobilising support for opportunities, for network operators to plan infrastructure investments, and for private investors who may wish to fund multiple projects across multiple areas simultaneously, if they are identified and documented following a consistent approach. Following a template should also result in cost efficiencies, as both the lead local government organisation, other stakeholders, and any external providers become familiar with the requirements when refreshing and updating plans.

An additional benefit of using a template and following a consistent structure is that it allows for any preparatory work in-between LAEP versions to be carried out. Tasks such as data collection, improved modelling, understanding of stakeholder constraints will all reduce uncertainty in an updated future version of the LAEP, and the lead local government organisations can tackle these with the knowledge that they *will* be required.

A standard template is provided listing sections and outputs for a LAEP (see *Annexe 1 - Template, Checklist, and Examples of Local Area Energy Planning*). It is recommended that a LAEP covers the following content[31]:

- Executive summary – providing a synopsis of the LAEP
- Context – providing details of the context for the LAEP (such as geographical area covered, current emissions, stakeholders involved)
- Assessing options for the Future – describe the methods used to model the local area, identify potential interventions and pathways to net zero.
- Intervention areas – describe the preferred pathway to net zero that the LAEP identifies.
- Next steps- describe the next steps for deploying the interventions that the LAEP identified.
- Technical annexes – covering further details not covered in the main LAEP, such as detailed modelling and data descriptions.

31 This is based upon LAEPs produced to-date, by ESC and other delivery contractors.

Step 7b Creating the draft LAEP

Creating a LAEP will draw information from each of the preceding six stages. A draft version is required initially and is reviewed by the Steering Group, before it is finalised in Step 7c. Table 15 shows the Stage from which information is required for each section of the report.

Table 15 shows the Stage from which information is required for each section of the report.

Further details of the suggested content in each section, and example outputs taken from LAEPs already completed, is shown in *Annexe 1 - Template, Checklist, and Examples of Local Area Energy Planning*.

Table 15: Sections of a LAEP

Section	Sub-section	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
Executive Summary	Introduction	■	■	■			
	Assessing options for the Future				■		
	Intervention Areas					■	■
Context	Geographical Area	■					
	Stakeholders	■	■				
	Policy Context	■					
	Emissions Inventory	■	■	■			
	Energy Profiles	■	■	■			
Assessing options for the Future	Which future scenarios?				■		
	How were they modelled?				■		
Intervention Areas	Energy efficiency in buildings					■	■
	Low carbon heating					■	■
	Industrial clusters					■	■
	Transport					■	■
	Local renewable generation					■	■
	Networks, storage, and flexibility					■	■
Next steps	Supporting implementation				■		■
	Actions				■		■
	Monitoring						■
Technical Annex		■	■	■	■	■	■

Step 7c Draft LAEP review and final approval

Objective: Review and final approval

The lead local government organisation is the ultimate owner of the LAEP and will approve the LAEP, but there are many primary and secondary stakeholders that will be impacted by the plan when it is implemented. Gaining their feedback and buy in, through engagement and consultation is vital to maximise chances of successful implementation. Network operators, as the other primary stakeholders, will provide critical feedback at this review and approval step.

Objective: Regional and national alignment

The usefulness of a LAEP is significantly enhanced if it can be aligned with other LAEPs in the region, and regions aligned nationally.

At the time of writing this Guidance, there is no mandate for LAEPs to be created for all local areas or regions. Neither is there a suitable body who can review and provide feedback and quality assurance on the created plans, highlighting potential areas of inconsistency between individual plans and comments on their deliverability.

The proposed standardisation of LAEPs, following the template (see *Annexe 1 - Template, Checklist, and Examples of Local Area Energy Planning*), will assist aggregation across regions and at a national level.

Step 7d Keeping the LAEP alive

Objective – Updating the LAEP

To keep pace with the emerging net zero picture, it is recommended that the LAEP is 'kept alive' between its initial creation and its future update. Changes to national and regional policy, technology developments, skills and labour availability all affect implementing the LAEP and should be tracked for incorporation into a future update. Significant changes could indeed trigger the requirement for an update to the LAEP.

It is hoped that any relationship between the LAEP and other processes will be formalised in the coming years, including national planning and network funding.

Given this, the development of a LAEP should be considered as the initial step in an ongoing process, which is likely to see periodic updates. While not fixed, given potential technology and policy changes it is likely that a LAEP would need to be updated on a rolling 3 to 5-year basis, aligning with both the current RIIO process for network companies and CCC carbon budget publications.

An indicative and high-level overview of the process from creating an initial LAEP to refreshing and updating it is shown in Figure 13.

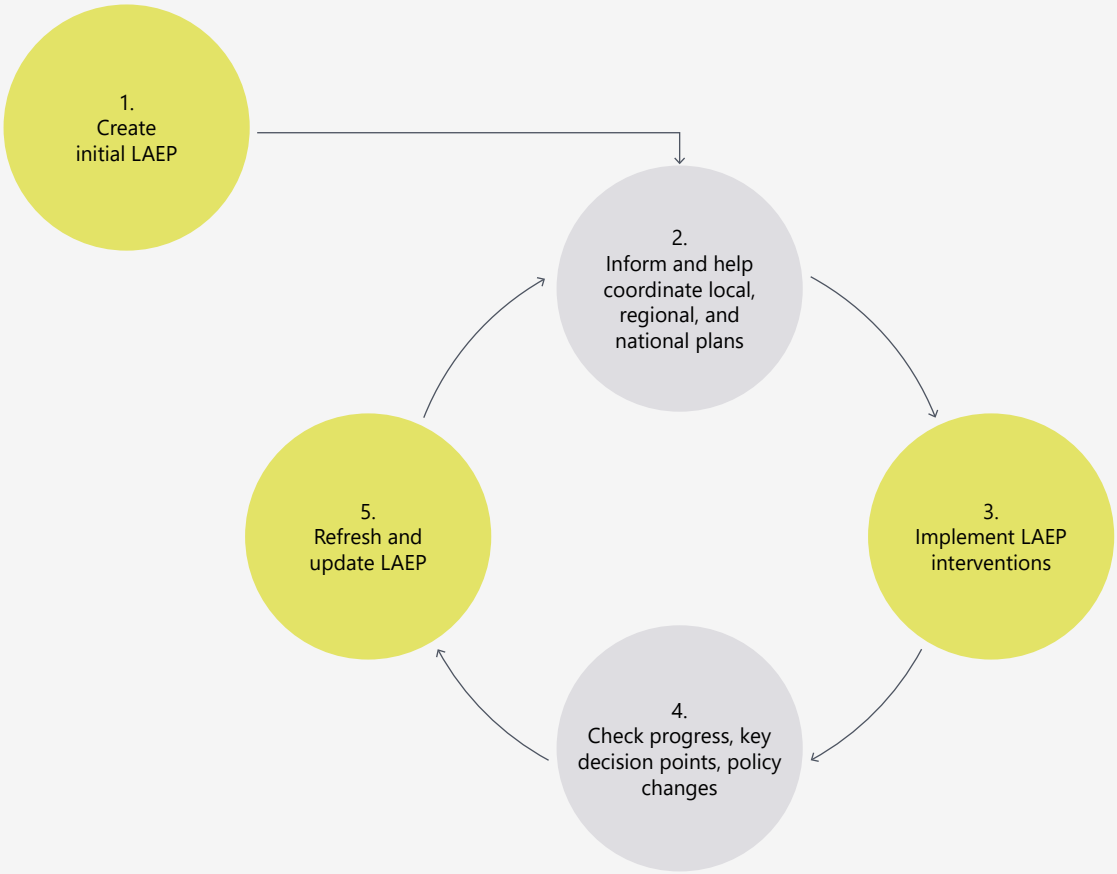


Figure 13: Indicative high-level overview of process from initial creation to refresh and update

Objective: Highlight risks and actions

In-between significant updates, there will be a need to track progress of priority actions and their implementation. Enhancing local data collection and sharing will also be important in achieving this and help build a base for subsequent updates. Other considerations include:

- Obtaining better data
- Improving modelling techniques
- Greater integration with networks on constraints and the DFES process
- Working with the regulator prior to RIIO on network spending
- Availability of grants and funding

Step 7e Next steps – implementation

Creating a LAEP is an important activity in support of transitioning a local area to net zero. However, creating a LAEP will not deliver decarbonisation unless the pathways and interventions that it highlights are implemented. Although implementation is included here as the final aspect of the Guidance on creating a LAEP, it is important that it is considered throughout the process and that all stakeholders consider the roles and responsibilities they could play in implementation.

The intention of a LAEP is not to create a barrier to undertaking any energy transition or project activity; it is intended to help plan future activity. This guidance does not require a LAEP to be in place before *any* energy transition or project is undertaken in the local area.

Objective: Consider the lead local government organisation's role in delivering the LAEP

The lead local government organisation should consider its role in implementing the LAEP, aligned to its roles and responsibilities outside of the LAEP, as well as the pathway of interventions identified by the LAEP. Part of the consideration should recognise the need to refresh and update the LAEP in the future; being an integral part of implementation will make future updates more efficient.

Objective: Record stakeholder interests in implementation

As well as considering the role of the lead local government organisation, the other stakeholders involved in the creation of the LAEP should identify their interest in implementation. This could build on the stakeholder mapping activity undertaken in Step 2b or align with the timeline of interventions in Step 6d.

Objective: Identify next steps

With a pathway and sequenced timeline of interventions identified, the next steps carrying on from the LAEP could include:

- Identifying where and how the LAEP can be aligned to other local government related energy transition activity.
- Securing wider stakeholder buy-in to the identified pathways.
- Carrying out feasibility studies of the interventions proposed in the chosen pathway and developing business cases where appropriate. Potentially prioritising projects that are within the control of the local authority (e.g., improving the energy efficiency of its own building stock).
- Working with government and other key stakeholders to establish policy and funding mechanisms.
- Establish any enabling actions or demonstration and scale up activity of interest to the lead local government organisation, such as testing how to successfully provide new technologies, products, and services.
- Identifying opportunities to combine projects and activities (possibly with other local areas) to gain economies of scale.
- Ongoing relationships and opportunities with the primary and secondary stakeholders that have supported the development of the LAEP, alongside potential interests in supporting implementation.
- Working with networks and organisations, such as the Local Net Zero Hubs and LEPs.
- Identifying any activity associated with developing partnerships with private companies and investors to enable action in cases where the local authority cannot act in isolation.
- Consider developing a Capital Investment Plan that brings together the policy and funding mechanisms and the work to identify private companies and investors who are looking to support projects.
- To help with implementation of identified projects, Net Zero Go is a tool that is freely available to local authorities to support them through the stages of a project life cycle, giving detailed advice at each stage[32].

32 https://www.netzerogo.org.uk/s/

Annexe

List of organisations who attended webinar sessions in February 2022:

Active Building Centre

Advanced Infrastructure

Arup

Association for Decentralised Energy

Buro Happold

Cadent

Calderdale Council

Centre for Sustainable Energy

City of York Council

Climate Change Committee

Cornwall Council

Department for Business, Energy and Industrial Strategy

Department for Levelling up, Housing and Communities

Dumfries and Galloway Council

Durham County Council

Electricity North West

Energy Networks Association

Engie UK

Greater London Authority

Greater South East Energy Hub

Hull City Council

Innovate UK

Isle of Wight Council

Leeds Beckett University

Leicester City Council

Liverpool City Region Combined Authority

Local Government Association

London Borough of Hounslow

Midlands Energy Hub

Mott MacDonald

National Grid

New Anglia Local Enterprise Partnership

Newcastle City Council

Newport City Council

Norfolk County Council

North East Energy Hub

North East Enterprise Partnership

North East Local Enterprise Partnership

North West Energy Hub

Northern Powergrid

Nottingham City Council

OFGEM

Regen

Royal Town Planning Institute

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Scottish Government

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West of England Combined Authority

West Yorkshire Combined Authority

Western Power Distribution

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