SOUTH YORKSHIRE SYMCA MAYORAL COMBINED AUTHORITY

north east & yorkshire NET ZERO HUB

CATAPULT Energy Systems

Spatial and Temporal Modelling



25/03/2024

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1. Executive summary

What is meant by Spatial and Temporal Modelling and why is it important?

The concept and practice of Spatial and Temporal Modelling (STeM) is still in its infancy, however, the important role it plays in local Net Zero strategic planning is clear.

Spatial and Temporal Modelling (STeM) is a spatial, data-driven modelling methodology with fixed targets (e.g. Net Zero by 2045), which allows its user to explore a range of credible pathways (e.g. energy decarbonisation) over a chosen period of time. Furthermore, it must be able to be updated to reflect local reality (e.g. a change of policy direction, updates to the grid etc). The four main attributes are laid out below:



Spatial

A range of credible pathways can be explored and mapped to a geography



Temporal

Pathways can be tested over time and changes can be incorporated



Adaptive

The outputs can be updated and calibrated against local reality



Goal-orientated

It is policy and strategy based with a fixed end goal (i.e. Net Zero by 2045)

Many local authorities are already using elements of STeM, particularly Geographical Information System (GIS) skills, to inform and support their **Strategic Net Zero Planning**. However, many local authorities also face barriers when implementing STeM. These include, but are not exclusive to: the understanding of what STeM is; funding uncertainty; lack of capacity or capability; ease of refreshability/dynamic use of the STeM tool; lack of consistency of input data; differing levels of access to tools; different levels of appetite across local authorities.

The purpose of this report is for the North East and Yorkshire Net Zero Hub and Energy Systems Catapult to identify the tools, data and skills required at local level to ensure Net Zero strategic planning has maximum impact.

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To develop this report, a four-stage approach was adopted

A four-stage approach was adopted to understand the case for STeM. This included a literature review, stakeholder engagement, a commercial solution landscape assessment, and final synthesis.

Stage	Stage 1: Literature review	Stage 2: Stakeholder engagement	Stage 3: Commercial solutions landscape	Stage 4: Synthesis and key findings
Activities	• Engage and secure time with North East and Yorkshire Net Zero Hub (NEYNZH) stakeholders • Literature review of leading players to inform economic and strategic cases	• Interviews, workshops, surveys and focus groups to engage with stakeholders • Documentation and capture of existing capacity, capability, needs and tools	• Development of a high-level assessment framework • Development of long and short list of vendors • Initial assessment and engagement with vendors • Support publication of expression of interest (EOI)	• Synthesise the analysis, research, engagement, and insights capture • Present key insights and proposals based on the research conducted during the project
	Pages 14 – 24	*Pages 25 – 36*	*Pages 37 – 43*	*Pages 44 – 52*

Note:

1. This report has focused on engagement and research in the north east of England. Some of the findings relating to local government structures are broadly applicable to devolved nations but will require further investigation and research to fully understand their applicability to other geographies beyond the north east of England.

2. The scope and definition of "digital twins" will not be discussed in this report. Instead, this report focuses on the capabilities local authorities might need to help them develop strategic plans.

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There is demonstrable value in STeM for strategic Net Zero planning

The engagement has shown the value that STeM can hold in terms of funding, identifying, and delivering projects. However, there is a broad spectrum of capabilities across different organisations that could be supported by additional capabilities.

There is demonstrable value in local Spatial and Temporal Modelling

There is significant literature published on the value of local view for strategic Net Zero planning that shows that whole system local area planning is the most robust, economic, and can provide greater social value than top-down approaches. However, not all STeM tools serve the same use cases. Pathway models[1] are more capable of providing confident evidence for funding and longer-term strategic plans. Whereas visualisation models are more suited to inform project delivery.



Developing plans and funding are linked and STeM tools can support this

Having a plan and delivering projects are not mutually exclusive; they can influence and inform each other.

There is value in proactively using STeM capabilities to develop plans and proposals, as in some cases funding can then follow.



Local authorities have different levels of capability, but there are quick-wins

Today there are significant limitations with local authorities' resources. However, there are elements of STeM functionality that could be broadly applicable and add value, and it will help authorities to develop and deliver project.

There is a need to think about levelling of assets and skills (What might be suitable for a local authority, combined authority, and Net Zero Hub)

Note:

1. Pathways models can optimise and model energy systems based on whole-systems inputs to provide robust evidence for plan delivery

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Local authorities' key needs and barriers were identified through interviews, surveys, and workshops

50 individuals across 26 different organisations across the North East and Yorkshire were engaged through the course of the engagement. The key insights are summarised below:

Modular Implementation	Strategic Guidance	Pathway/Scenario Modelling	Solution requirements	Solution Governance
A modular approach to introduce STeM, beginning with the visualisation of energy system, and socio-economic and existing decarbonisation pathway data would be beneficial to cater to different needs found across the different local authorities.	STeM, primarily pathway models, can provide valuable strategic guidance to inform project delivery and secure funding/investment.	Limited engagement with pathway/scenario modelling was highlighted across many organisations e.g. local authorities, combined authorities, and the Net Zero Hub.	Local authorities saw value in in-house GIS training and tools that do not require third parties/expert-user training. However, such tools are generally currently unable to provide the detail and granularity of a Local Area Energy Plan (LAEP).	Different levels of local government could own different elements of spatial and temporal modelling. However, based on current analysis there wouldn't be the capability to own and manage a complex pathway model within these organisations.

These key insights are an amalgamation of the expressed experiences, needs and expertise of the stakeholders. The findings from each individual engagement are detailed in the next pages. Further details of the stakeholder engagement can be found in section 4.

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The project explored commercially available products' costs, functions, and skills

A structured method was adopted to research different tools. The approach included: developing a functional framework based on needs; establishing a longlist; refining this to a shortlist; conducting an expression of interest with promising suppliers.

Develop functional framework

A functional framework was developed based on the literature review, and insights from the stakeholder engagement. The purpose of the framework is to describe the different capabilities that tools could support and provide a common definition for assessment.

Longlist

A longlist of different STeM tools was developed to provide a high-level view of the different tools available and an initial high-level assessment of their capabilities.

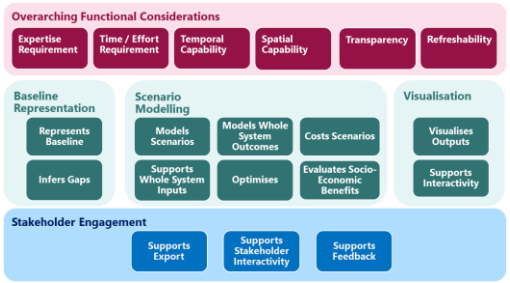
Shortlist

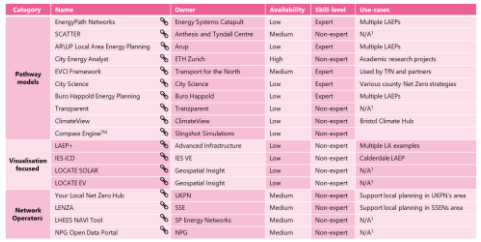
A desk-based review identified the most promising tools from the shortlist, based on their ability to deliver the capabilities within the functional framework.

NOTE: this assessment was a qualitative assessment based on publicly available information.

Expression of interest

The most promising tools identified during the shortlisting process (i.e. the tools that seemed to best deliver on the needs of Local Authorities) were then invited to respond to an expression of interest. Respondents were asked to provide a view of what capabilities they can deliver today, and the capabilities that are currently under development.







Further details of the commercial landscape work can be found in section 5.

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The skills, data, tools, and use cases needed for STeM vary across the planning journey

From the literature review and stakeholder engagement, it was clear that the STeM needs vary across the strategic Net Zero planning journey, and therefore the appropriate STeM capabilities will change depending on the activity being undertaken.

Time horizon

	Long-term strategic planning	Annual review of progress and decarbonisation	Project delivery, monitoring and evaluation
	As part of longer-term strategic Net Zero planning more complex STeM capabilities such as whole-system optimisation are needed to create a pathway of what might happen and provide robust modelling and deliverable decarbonisation plan that also delivers wider social outcomes.	As part of regular progress reviews, there may be the need to view and track progress against a strategic plan. This may include visualisation and representation of local area assets alongside socio-economic data.	Over the shorter term, there are more ad hoc needs to support individual initiatives, monitoring, and evaluation that could be delivered using visualisation and baselining toolkits.
Timescale	**Long-term (updated every 5 years)**	**Semi-regular updates (annual)**	**Short-term (< annual)**
Skills	Data modelling, data analysis, data interpretation stakeholder engagement	Data modelling, data analysis, data interpretation, stakeholder engagement	Stakeholder engagement, project delivery
Tool capabilities (from the functional framework)	Represents Baseline; Models Scenarios; Models Whole System Outcomes; Costs Scenarios; Temporal Capability; Infers Gaps; Supports Whole System Inputs; Optimises; Evaluates Socio-Economic Benefits; Spatial Capability; Supports Export; Supports Stakeholder Interactivity; Supports Feedback	Models Scenarios; Models Whole System Outcomes; Costs Scenarios; Visualises Outputs; Refreshability; Supports Whole System Inputs; Optimises; Evaluates Socio-Economic Benefits; Supports Interactivity; Spatial Capability; Supports Export; Supports Stakeholder Interactivity; Supports Feedback	Visualises Outputs; Refreshability; Supports Interactivity; Spatial Capability; Supports Export; Supports Stakeholder Interactivity; Supports Feedback
Outcome	Strategic plan	Update baseline	Inform individual project delivery
Data	Baseline data, broader energy system data	Local data recently updated	Local data recently updated

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The summary findings show there is a need for STeM and an emerging market of offerings

The summary findings showed that there is a potential need that STeM capabilities could support. However, the exact needs and ownership of these capabilities will vary based on the stage of the journey and the structure of local government in a place.

Local authority Needs

Local and combined authorities have a **range of unmet needs** when it comes to supporting STeM for strategic Net Zero planning. Notably, there appears to be a **lack of awareness of data quality and availability**, and the potential **impact** this could have on a plan. A future governance could support different levels of government investing in assets to maximise impact for local authorities.

The STeM Opportunity

Strategic Net Zero planning can be supported by greater Spatial and Temporal Modelling capabilities which many local and combined **authorities showcase at least a minimum level.** However, the specific capabilities needed vary on the use-case and stage of the journey.

Ownership

There is an opportunity for **different levels of local government** to **collaborate and share resources** to support Spatial and Temporal Modelling. This project has **outlined a potential governance model** for two-tier authorities (like those found in the North East of England). Further analysis is needed to understand the potential impact on other local government structures.

Functional Framework

The functional framework captures the **breadth of scope needed** from a tool to support different STeM use cases at different journey stages. These **range from advanced whole-systems pathway** creation as part of a LAEP process, to **tactical visualisation** for project delivery.

Modular approach

STeM needs will change depending on where **organisations are in the journey and data, tools, and skills should be** tailored accordingly.

A **modular approach to STeM tools** and capabilities can help local authorities to develop and deliver Net Zero plans. **Pathways optimisation** and **modelling capabilities may set the strategic** direction and **visualisation tools are more suitable** for project delivery.

Commercially available tools

There is a range of commercially available tools across different capabilities with an emerging roadmap of tools that deliver more complex optimisation functions.

There is an opportunity for the commercial market to work with local government stakeholders to develop tools that deliver to their unique needs.

Further details of the summary and observations can be found in section 7.

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2. Purpose and context

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What is Spatial and Temporal Modelling and is it important?

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3.
Literature review

Spatial and Temporal Modelling is critical to strategic Net Zero planning

STeM provides a powerful evidence base to help organisations plan for uncertainty and to inform the decisions required to achieve a secure and low-carbon energy supply.

What is STeM?

Strategic Net Zero planning is the analysis of a defined physical area, identifying current conditions as well as future demands and opportunities. A representative system is modelled, choosing different engineering and societal parameters to drive Net Zero planning to achieve strategic outputs (e.g. retrofit for public health benefits as well as carbon abatement)

Spatial and Temporal Modelling (STeM) considers changes over time. This specifically means that the system model contains projections of how variables will change over time to create a range of credible scenarios for strategic Net Zero planning. These can be updated at the desired intervals, to capture changes that have occurred and planning strategies can respond and adapt.

STeM in Energy at National Level

There is an urgent need to use STeM to support robust, data-driven plans for the Net Zero transition which consider how spatial plans will evolve over time, in particular for infrastructure planning (Including energy, water, telecoms, and transport).

In their 'Delivering for 2035' report, National Grid identified the establishment of a **Strategic Spatial Energy Plan** (SSEP) by 2025 as a key action to enable decarbonisation of the grid and that the SSEP should set out what needs to be built, where and when.

The scope of the plan is to be at the national level, however, it must **align with new Regional System Plans and Local Area Energy Plans** (LAEP).

There are existing examples of STeM in energy such as **Future Energy Scenarios** (FES) and **Distributed Future Energy Scenarios** (DFES), however, to ensure a 2035 delivery of Net Zero, capabilities in key organisations still need to be built.



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The case for a local area approach to strategic Net Zero planning

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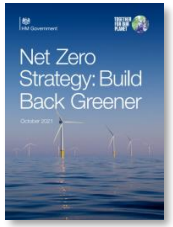
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There is consistent evidence that a whole system, local area approach to strategic Net Zero planning is the most robust, economic and can provide greater social value than top-down approaches.

'Net Zero Strategy: Build Back Greener'

The UK government's 2021 Net Zero Strategy estimates that **82% of the UK's emissions are "within the scope of influence of local authorities"**.

It not only recognises the key role local governments hold in facilitating the delivery of national targets, but also their ability to do so in a cost-effective manner. Therefore, **a place-based approach is championed** as a one-size-fits-all approach is not as efficient or impactful.



'Delivering for 2035'

In addition to the case for a local approach to energy planning, the report by National Grid also identifies the **need to put communities at the forefront of the transition** as one of the five key areas to deliver Net Zero.

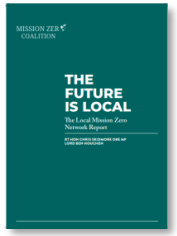
It names **local authorities as crucial actors in the delivery of low-carbon infrastructure** within their communities. As local experts and representatives, their involvement is necessary to help ensure local people secure real value, drive affordability, and maintain popular support.



'The Future is Local'

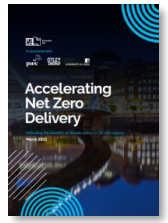
'The Future is Local' is the "Local Mission Zero Network Report" by Chris Skidmore OBE details how a local approach will bring:

- **Greater economic growth and the strengthening of local economies** through the investment and quality job opportunities Net Zero can bring.
- **Greater efficiency of delivery** through local expertise, local energy production and better public engagement, trust and ownership
- Hasten the adoption, consistency and success of LAEP across the UK.



'Accelerating Net Zero Delivery'

The UKRI's report found that **"a place-specific approach delivers more benefit for less cost".** This was evidenced by comparing it against a **place-agnostic** approach which, to achieve the Sixth Carbon Budget, would require **£195 billion** of investment and would in turn provide **£57 billion** in energy savings. The **place-specific** scenario would require only **£58 billion** of investment and return **£108 billion** in energy savings. It also estimates that a place-specific approach would, for **~£140 billion** less investment, deliver almost **double the societal benefit** at £825 billion.



The Time and Place is Now

The Catapult's recent report, **Local Area Energy Planning - The Time and Place is Now**, identifies that there has been growth in the number of local authorities with, or working towards, Local Area Energy Plans from **15 in 2021 to 66 in 2023** showing the increasing adoption within local councils.



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FES and DFES are examples of STeM in energy planning

Future Energy Scenarios (FES) and Distribution Future Energy Scenarios (DFES) are examples of Spatial and Temporal Modelling that is carried out by the Electricity System Operator (ESO) and Distribution Network Operators (DNO) today.

Future Energy Scenarios

FES outlines four pathways for the future of the whole energy system out to 2050. Each pathway details how much energy the UK may need and where it could come from.

The four pathways are:

1. **Consumer Transformation** – driven by higher levels of consumer engagement;
2. **System Transformation** – driven by system transformation on the supply side**;**
3. **Leading the Way** which assumes rapid decarbonisation and**;**
4. **Falling Short** which is ongoing increased levels of decarbonisation compared to current efforts but less than the other pathways.

FES is widely used by stakeholders across the energy sector to inform energy networks and Net Zero technology investments, advise national and regional policy, and conduct academic research and innovation.

Distributed Future Energy Scenarios

DFES are developed DNOs to provide granular future energy scenario projections for the distribution network areas.

Regen has pioneered the Distributed Future Energy Scenarios (DFES) approach, an analysis-based method that directly supports electricity and gas networks with long-term strategy and network planning processes, at a localised level.

Element Energy has also developed a DFES model which illustrates energy futures with different levels of decentralisation, decarbonisation and digitlisation. These scenarios are derived from a series of key drivers e.g., the number of EVs, low-carbon heating technology choices, and installation of distributed generation.

Ultimately, local strategic Net Zero plans can build on and feed into the DFES and FES models. However, these strategic Net Zero plans will also need to be driven by the local area themselves to ensure that they represent the unique needs of a place.

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Local Area Energy Planning is an established approach to Net Zero Strategic Planning

The literature evidences the strategic importance and economic logic of a local approach to energy and Net Zero planning. A part of Net Zero strategic planning in the UK is the Local Area Energy Planning (LAEP) methodology.

LAEPs are a response to the need for a 'place-specific' approach to local decarbonisation and create a plan for the best cost scenario for the Net Zero transition. The Catapult has developed the following definition:

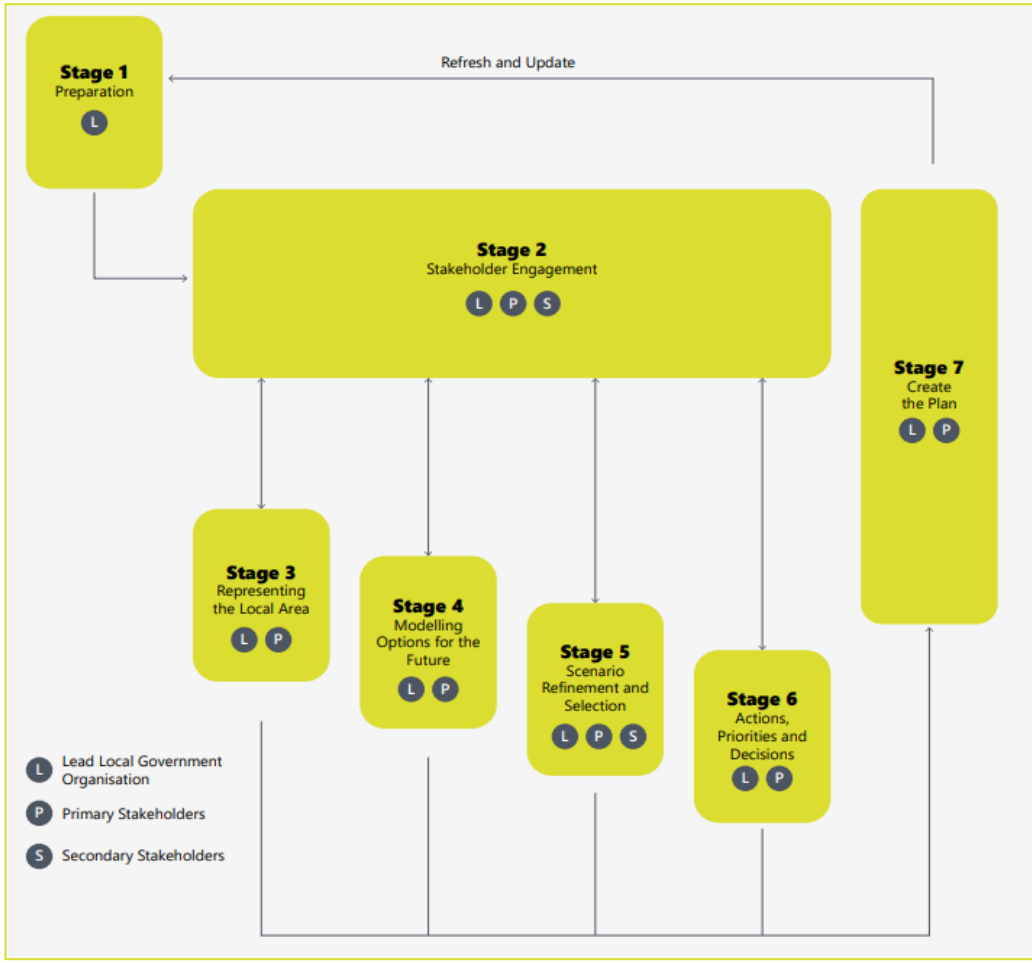
"LAEP is a **data driven and whole energy system, evidence-based approach that is led by local government** developed collaboratively with defined stakeholders. It sets out to identify the most effective route for the local area to contribute towards meeting the national Net Zero target, as well as meeting its local Net Zero target."

The seven stages of LAEP can be seen on the right.

A 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'.

Many of the results and outputs of LAEP (and any other local energy plans that is developed by local government) can provide details of local energy needs and capacity which is informed by a bottom-up stakeholder and data-led approach. This detail is a vital resource that can provide local context for top-down network and spatial planning.

The LAEP places more focus on the techno-economic factors of the energy system rather than wider local place strategies such as economic growth, regeneration etc.



Note: LAEP is one approach to Net Zero Strategic Planning. Some local authorities are choosing to take a different approaches using other methodologies such as the Zero Carbon Oxford roadmap.

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Regional and national scale spatial planning should reflect local strategic Net Zero plans

There are different spatial and associated 'levels' at which energy plans are considered and published in the UK;

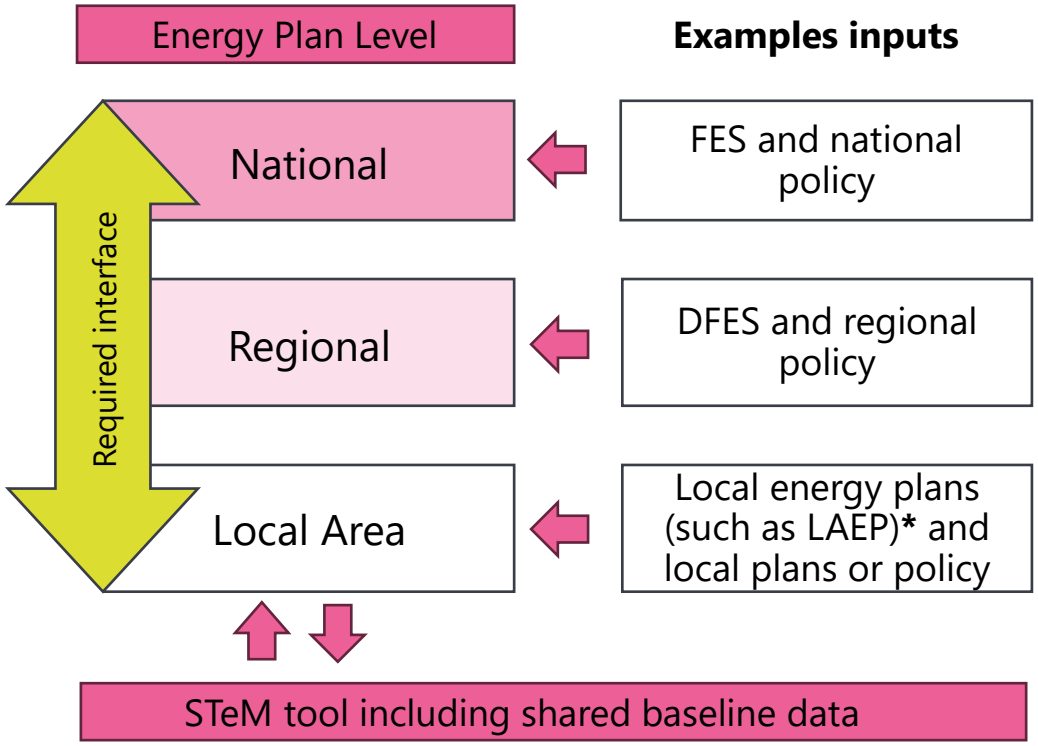
- **National** (by UK government and transmission operators)
- **Regional** (by county councils, regional bodies, and distribution operators)
- **Local Area** (by city / district / borough authorities and distribution network operators)

There needs to be a bidirectional interaction between each layer. For example, a national target set will need to appropriately and proportionately inform, and be informed by, the regional plans. Similar interactions need to take place between the regional and local plans.

The diagram to the right illustrates the complex interactions and dependencies between each Energy Plan level.

Note: Ofgem has recently confirmed the creation of dedicated regional energy planning roles - Regional Energy Strategic Planners (RESPs) - who will work with local government and organisations to improve the interface between the levels. Furthermore, the government has confirmed the development of a national Strategic Spatial Energy Plan to bridge the gap between policy and network development plans.

Cohesion across National, Regional and Local Plans



*To note, LAEPs can also be done on a regional as well local level

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Strategic Net Zero plans require Temporal Capacity

The importance of local strategic Net Zero plans for national and regional planning is clear, however, the resulting data model is only a snapshot in time. Therefore, temporal capacity in strategic Net Zero planning is required to ensure that the most accurate ongoing picture of local capacity and needs is provided to aid implementations and reassessment of plans.

Long-term vision which develops over time

Currently, Net Zero strategic planning is centered around a long-term vision with a view of near-term priorities, low regret investment, and quick wins. This means that many Net Zero strategic plans currently present a pathway for the energy transition **fixed to their point of time** of publication.

Dynamic Local Energy Systems

However, **local energy systems are becoming increasingly dynamic**. Implementation of Net Zero pathways requires coordinated activity of a range of disconnected actors. Therefore, an important ability of Net Zero implementation **the ability to respond** to technological, political, and local change. STeM is a capability that can support this.

Note: There is a tension between giving confidence and certainty to stakeholders on the plan and ambitions and adapting to the evolving technological, political, and local change in doing so reducing the certainty in the plan itself.

Delivery need

To deliver STeM there is a need to understand how best to deploy:

- **Tools and Modelling:** Updating retain accurate energy representation and understanding of the local energy context, creating/updating the plan accordingly.
- **Data:** to enable accurate modelling, comprehensive and timely data sets from various sources.
- **People and Skills:** the targeted user groups need to be equipped with the necessary capability and resource to update the modelling tools.

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Delivering on Spatial and Temporal Modelling will require skills, tools, and data

For places to deliver on spatial and temporal modelling, there are 3 key areas of capability that are needed: **people and skills, tools and modelling, and data.**

People and skills

For the uptake of spatial and temporal modeling tools to be successful, the user group needs to be equipped with the appropriate skills and expertise to deliver spatial and temporal modeling. These skills should cover all the stages of whole systems planning.

Fraser and Nash Consultancy released a report on local authorities' approach to EV charge point implementation[1]. They found that, out of the nine local authorities they engaged with, six reported a shortage of either geospatial expertise or faced resourcing constraints. This led to either having to hire external consultants or foregoing the use of geospatial tools for their analysis.

As part of the UK Geospatial Strategy activities, a report on the demand for geospatial skills has been produced, which identifies the various skills needed for spatial planning; in particular:

1. Data collection
2. Data Interpretation and Analysis
3. Sector-specific skills (E.g. Precision agriculture, hydrographic modelling)

Tools and modelling

Software and modelling tools are needed to undertake the computation, scenario development and visualisation needed to create, communicate and deliver a strategic Net Zero plan. Based on experience developing Local Area Energy Plans, the typical capability areas of software tools include **baseline representation**, **scenario modelling and optimisation**, **pathway visualisation**, **manipulable project planning**, and **stakeholder engagement**.

As part of this literature review, the different tools' offerings are grouped as:

- Pathway models
- Visualisation focused
- Network engagement tools

Note: This view is developed further in section 5 of this report 'Commercial market landscape'.

Data

Local spatial and temporal modelling requires datasets from a range of sources (infrastructure, geographical, population and growth forecasts, and socio-economic data) to inform planning development and scenario optimisation. Several publications have attempted to capture the different inputs needed:

1. The Catapult released has released LAEP Guidance which outlines some of the key datasets that are typically used as part of LAEP.
2. Electricity and gas networks are starting to publish their data openly for use via their open data portals. One example of this is UK Power Networks. UK Power Networks have worked with Regen to publish a guide of their data for strategic Net Zero planning.
3. As part of the Fraser Nash report, it was suggested that "a best practice guide or "playbook" could: provide a prioritised list of geospatial data sources and their role in EVCI analysis and planning". This idea could be expanded to include wider spatial and temporal modeling.

In addition to the type of data, the quality of the data is also important. This can vary substantially across different geographies.

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STeM skills range from collecting data, to developing, validating and delivering plans.

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Having access to skills and people capable of carrying out STeM is important to ensure that places can develop and wider Net Zero plans on an enduring basis as technology, plans and implementation project evolve.

Data collection

The ability to **collect reliable and credible data relevant to the local area** ensures that plans are **well-informed**. The geospatial demand report highlights remote sensing, topographic survey, LiDAR, and field surveys within its report.

More broadly, within strategic Net Zero planning, this will extend to the **knowledge and understanding of the availability** and **terms for different datasets** needed for strategic Net Zero planning.

Data collection should not be underestimated. **Significant expertise is needed to gather, cleanse, and format** data from different actors.

Sector specific

The Geospatial Skills Report highlights the need for sector-specific skills.

For Net Zero strategic planning, knowledge of the **different energy system decarbonisation pathway options** is needed – and the ability to keep this knowledge up to date. **For example, knowledge of the different decarbonisation pathways for heat;** what might be suitable given different social; and infrastructure characteristics of a particular area. Furthermore, the ability to communicate key messages and trade-offs to stakeholders is also required.

Data interpretation and analysis

The Demand for Geospatial skills report requires experience working with GIS software, logistics analysis, and geospatial intelligence.

When related to Net Zero strategic planning, this specifically relates to the **ability to model future decarbonisation pathways** and **optimise potential options** based on infrastructure availability, social impact, and strategic consideration. **Sector-specific knowledge extends into this skill** as there is the requirement to understand and make decisions around the energy system based on the presented data.

Stakeholder engagement and facilitating decision

In addition to the three skills identified in the Geospatial skills report, there is the **ability to engage and consult with local areas** on the different plans and options.

This is a crucial part of the process of creating and developing plans over time.

Note: Further development of the current capabilities and skills will be explored during stakeholder engagement.

Geospatial skills | **Broader engagement skills**

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Different tools support different use-cases and have a range of delivery benefits

To categorise tools available to local authorities, we've grouped the tools into 3 groups **Pathway models**, **Visualisation-focused tools**, and **Network engagement tools**. There is variation in the complexity and capability of different tools within each category.

Pathway models

Pathway models focus on **evaluating possible transitions** over time from the current energy system to a **possible future system in an area**, typically showing the timings of these changes. This often involves producing a **representation of the energy system as it exists now** and then **determining a set of interventions** - this could be driven purely by scenario assumptions or on an optimisation process. For example, to achieve a Net Zero target by a certain date.

Examples:
Energy Systems Catapult – Energy Path Networks
Buro Happold tool
Arup
Scatter
City Science

Visualisation-focused tools

The visualisation tools focus on **providing a visualisation of elements of the energy system**. This could involve highlighting existing aspects of the current energy system, such as **existing renewable generation**, or **indicating areas of possible change**, such as by showing suitable locations for new renewable generation potential. As such, a **specific pathway to a future energy system is typically not generated**, though some platforms can ingest data on pathways which have been generated elsewhere and provide visual mapping of them.

Examples:
LAEP+
Locate Solar
City Energy Analyst
IES energy master planning

Network engagement tools

These are a **set of tools that are hosted by the electricity networks** that aim to facilitate plan development. This often includes **evaluating impacts of changes to the energy system on electricity networks**, usually at the distribution level. This can consist of both understanding the current energy system and evaluating possible interventions, but in a manner that aligns specifically to understanding the electricity network impacts of these interventions. Combinations of interventions may be tested, but optimised pathways are typically not generated.

Examples:
Your Local Net Zero Hub
Lenza (SSEN)
LHEES Navi Tool
NPG vulnerabilities map

Net Zero Go

While not strictly a STeM tool, Net Zero Go is a **digital platform developed by the Catapult where local authority officers can create, develop, and manage successful local energy projects**, build their own knowledge, access templates to speed up their processes and collaborate with peers in order to deliver their Net Zero projects all in one place.

This aims to provide support for implementation of a plan after the spatial and temporal plan has been created. Also includes signposting to energy project data (open & commercial), guidance for data and local area planning targeted at the project officer level.

Note: The findings in this report are based on initial desk-based research and not all tools within one category will be equal in capability and functionality

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A range of datasets needed to support STeM for Net Zero strategic planning

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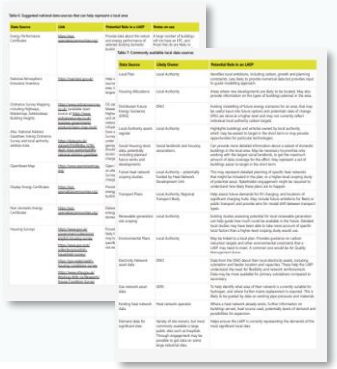
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Strategic Net Zero Planning brings together UK government statistics, local plans, socioeconomic, and energy infrastructure, combined with the climate ambitions of an area and local priorities to develop Net Zero plans. Some examples are given below:

Energy Systems Catapult LAEP guidance and Net Zero Data

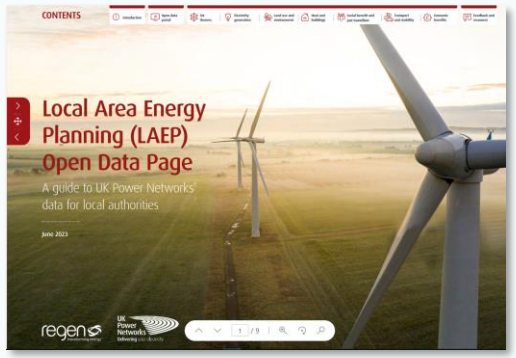
Within the LAEP guidance , the Catapult outlines the datasets that generally feed into LAEP. This includes a list of local and national datasets including, but not limited to, Energy Performance Certificates, OS mapping. A full list is available in the main report and data annex.

In addition, the Catapult also has a growing data portal with its Net Zero Data range of datasets, both open & commercial, easily accessible to local authorities.



UK Power Networks Open data pages

UK Power Networks have published a page to make it easier for local authorities and Local Area Energy Planning practitioners to find data for Net Zero planning. The page outlines 6 themes of local planning covering "Electricity Generation", "Land use and environment", "Heat and buildings", "Social benefits and just transition", "Transport and mobility", and "Economic benefits". Across each of the themes, specific datasets are identified.



Fraser Nash – Electric Vehicle charging infrastructure report

The Electric Vehicle Charging Infrastructure report identifies data as a critical foundation of local infrastructure planning.

"Good data made available to the right people, at the right time is crucial in understanding EVCI demand for a given area"

The datasets used as part of the EVCI process can be grouped as:

1. Location and status of existing EVCI
2. Electricity network capacity and availability;
3. On and off-street parking locations;
4. Land Ownership.



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4. Stakeholder engagement

Three stakeholder groups were identified as part of scoping

Relevant stakeholder groups were identified to allow the development of a holistic and tailored engagement approach. The following three groups were identified:

Core stakeholders

These are the different local government groups that sit within the area of NEY NZH.

Who:

- All local and combined authorities within the area of North East and Yorkshire Net Zero Hub (NEYNZH) (see page 28 for a full list)
- Hull and East Yorkshire Local Enterprise Partnership
- York and North Yorkshire Local Enterprise Partnership

Engagement purpose:
To understand what **skills** and **capabilities** are currently present within the local authorities; what **tools** and **datasets** they use and what their **local need** is.

Wider Net Zero Hub stakeholders

This group represents the wider perspectives from different local authority groups relevant to STeM and strategic Net Zero planning.

Who:

- Local authorities outside of the NEYNZH area
- Combined authorities outside of the NEYNZH area
- Other Net Zero Hubs

Engagement purpose:
To gain a **broad range of perspectives** to understand the ambition and needs for strategic Net Zero planning as well as their experience of planning and capability to-date.

Ofgem, Northern Power Grid and National Grid Transmission

These are the network operators and regulators. They are important because regulation, policy, and national infrastructure needs to interface with and support local strategic Net Zero plans. Understanding their requirements is important to help inform regional and national infrastructure and policy plans.

Who:

- Ofgem
- Northern power grid
- National Grid
- Northern Gas Network

This group was identified because of the role they play in whole systems change. However, limited engagement was conducted with them for this project due to the current uncertainty of the Regional Energy Strategic Planner role.

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Different engagement approaches were adopted for the different stakeholder groups

Three stakeholder engagement approaches were developed for both depth and breadth of insight into the current landscape of spatial Net Zero planning at local level. The methods used are detailed below:

Engagements conducted



Interviews
A series of in-depth interviews with data and/or Net Zero personnel within local authorities of the NEYNZH area were held.



Survey
A survey was sent out to the core and wider stakeholder groups to capture broader perspectives.



Workshop
A workshop with the combined authorities and Net Zero Hub staff was organised to test and build on interview and survey insights.

The variation of structure and resulting insights gathered for each engagement brought unique value to understanding the current landscapes. The interviews brought detailed and free-flowing conversations; the survey results provided us with a structured data pool of wider perspectives and the workshop allowed us to gain the combined authorities' and Hubs' perspectives on the gathered interview and survey insights giving additional context and a deeper understanding.

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Many stakeholder organisations partook in the engagement sessions

The organisations which contributed to engagement sessions are detailed below. **The Catapult wishes to extend a huge thank you to all who took the time to participate and contribute in the engagement sessions.**

In-depth Interviews

Interviews were held with 11 individuals across the following local authorities:

Leeds City Council
Durham County Council
Hull City Council
Northumberland County Council
Kirklees Council
Redcar and Cleveland
City of York Council

Survey

24 respondents from the following organisations responded to the survey:
East Ring of Yorkshire Council
South Gloucestershire Council
Barnsley Metropolitan Borough Council
Hartlepool Borough Council
Wakefield Council
Redcar & Cleveland Council
Sheffield City Council
Nottingham City Council
Stockton-on-Tees Borough Council
Hull City Council

West of England Mayoral combined authority
North of Tyne combined authority
Tees Valley combined authority

Hull and East Yorkshire Local Enterprise Partnership
York and North Yorkshire Local Enterprise Partnership

Midlands Net Zero Hub
South West Net Zero Hub
North West Net Zero Hub
North East and Yorkshire Net Zero Hub

Workshop

8 individuals from the following organisations were in attendance of the workshop:

Tees Valley combined authority
Liverpool City Region combined authority
Midlands Net Zero Hub
North East and Yorkshire Net Zero Hub

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The key insights gathered across all engagements

After all engagements were conducted, the gathered insights were carefully analysed and considered, alongside the literary findings, to identify five key insights:

Key Insight	Description
Modular Implementation	A modular approach to introduce STeM, beginning with the mapping and visualisation and progressing to full pathways modelling of Net Zero and existing pathway data would be beneficial to cater to different needs found across the different local authorities.
Strategic Guidance	Different STeM capabilities can provide valuable strategic guidance to inform project delivery and secure funding/investment. For example, scenario and pathway modelling can act as a strategic "north star", whereas asset visualisation can support project scoping and delivery.
Pathway/Scenario Modelling	Limited engagement with pathway/scenario modelling within organisation was highlighted across many organisations (such as local authorities, combined authorities, and Net Zero Hubs). Many have not engaged with external support for pathway and scenario modelling.
Solution Requirements	Local authorities saw value in in-house GIS training and tools that do not require third parties/expert-user training. However, such tools are generally currently unable to generate the detail and granularity of a LAEP, only visualise it.
Solution Governance	Combined authorities could own the data and commercial tools and the local authorities could own the delivery of the projects. However, based on current analysis there wouldn't be the capability to own and manage a complex pathway model within these organisations.

These key insights are an amalgamation of the expressed experiences, needs and expertise of the stakeholders. The findings from each individual engagement are detailed in the next pages.

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Findings from the in-depth interviews

The series of interviews gave the opportunity to have informative and diverse conversations with Net Zero and/or data personnel at the local authorities. The collected insights are detailed below:

Skills and Capabilities	Tools	Data	Value	Barriers
There were **a range of maturity** levels of all the local authorities spoken to. Ranging from having a climate team with **dedicated Business Intelligence (BI) individuals, or having a separate GIS/data team** which operate council wide that they can request resource from, to only a small (three people) climate team with limited GIS/data capability.	**Different tools** were mentioned by local authorities including: • ARCGIS • Power BI • Tableau • Mapinfo • QGIS • Compass Map • Transport for the North • SCATTER	Different data was mentioned by local authorities including: • **Pathways Data** (Parity project) • **Home Analytics data** (Energy saving trust) • **Socio Economic data** • **Network data** (The need for) • **EPC** data • DNO data (Limited availability)	The value of **spatial planning was recognised across all local authorities** - mapping network constraints was frequently mentioned as valuable but also difficult to attain. The value of **place-based approach was demonstrated** by project stories. STeM is thought to bring value by providing granularity especially where there is the disparity in different parameters. One local authority indicated that the LAEP had been **valuable in obtaining funding** for future projects but was not a major reason for the LAEP in the first place.	Several barriers were highlighted: •**Non-interoperable policy** for retrofit grants •**Funding** for internal teams and stretch capacity •**Access** to network data •Importance of **working with partners / stakeholders** was highlighted. • If STeM were to be introduced into a climate/Net Zero team**, lack of capacity / skill for somebody to own and operate the model.**

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Findings from the survey

The survey was an opportunity to capture a wider perspective. 24 responses were gathered. The following findings were collected:

Skills and Capabilities	Tools	Data	Barriers
58% of organisations are already using GIS/STeM to model Net Zero data. Data modelling was frequently mentioned skill at only **9%** reporting capability. The highest occurrence recorded only stands at **20%** (for data collection, data analysis and sector-specific skills). There was ~60/40 split between inhouse and outsourcing STeM skills respectively.	If using GIS/STeM, visualisation models are the most common type of tool utilised at **42%.** **32%** indicated use of pathway models and **21%** use tools provided by networks.	The most common datasets (socioeconomic and local plans) are only used by **26%** of organisations. This suggests the datasets are mostly used in isolation. **50%** of organisations are using external STeM outputs with the most common being DFES and DNO data.	The most common barriers stated are 'access to skills' and 'access to data', both at **20%. '**Access to technology' follows closely at **17%.** 'Cost' was named as the least prevalent barrier at **9%.** Policy and political systems outside of local authorities' control were named as additional barriers to project implementation.

Summarised Insights

The low occurrence of GIS/STeM use and modelling capacity skills supports the interview findings that many local authorities would benefit from a modular introduction of STeM beginning with spatial capability.

This is further supported by many organisations' responses centering around the visualisation of static data when asked how GIS/STeM would benefit their operation.

In addition, there is the desire to upskill internal staff in GIS/STeM.

Although 'cost' was named as the least prevalent barrier, cost underpins skills, capacity data and tools.

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Findings from the workshop

The workshop allowed us to playback and test the interview and survey findings with the expertise and viewpoints of the combined authority and Net Zero Hub staff. The following points were captured:

Skills and Capabilities	Tools	Data	Barriers
GIS is often seen as a skill only for those with **pre-existing qualification/training**. **Lack of clarity and understanding** what GIS/STeM is – local authorities may not be aware they are using it. Data skills are seldom included in **local authority hiring** standards/seen as a must-have.	Tools hold an **important link to investments** i.e. the Greater Manchester LAEP informed spatial plan which led to detailed heat pump investment plan. Guidance needed on which tool (capability) should be utilised at **different strategic planning/master planning and project delivery stages and how these may be integrated.**	The suggested fragmented use of data could be **driven by isolated funding streams** e.g. EVs, rather than strategic streams. There is a need for the **standardisation of strategic planning data** to ensure consistency amongst local authorities and interoperability of their local plans' interaction with regional plans etc. There is a call for a **minimum data requirement** for a STeM/LAEP to be set for a 'light-touch' approach.	There is a concern that **LAEPs are not dynamic**, representing only a moment in time. **Siloed data architecture and responsibilities** within and among local authorities. There is a **cultural shift needed** in a way projects are developed to move towards a data-driven approach.

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Findings from the workshop continued…

The workshop was also used as an opportunity to test ideation and implementation of the solution. The following feedback was gathered:

Solution Ideation

The solution should:

- Provide standards for data and modelling to enable interoperability of results
- Have a 'light-touch'/minimum option
- Provide a level of training to public sector staff which will allow them to understand and challenge GIS assumptions
- Demonstrate value i.e. investment securement, strategic guidance

The solution should not:

- Deter the user with bad user interface design
- Require a high qualification/experience level
- Be unable to justify expense with results
- Be exclusively externally supported but rely on local knowledge/skills

Solution Implementation

Where should the solution sit in the local authority, combined authority and Net Zero Hub structure?

Net Zero Hub	The Hub **could** take on an advisory/ coordinator role, providing expertise as it cannot own any assets i.e. models, datasets.
Combined authority	Combined authorities could manage the creation of work and own the model, providing most of the needed skills and capacity.
Local authority	Local authorities could own the delivery of the projects.

Please note: This is an indicative suggestion based on the georgraphy of the north east and its local government structure. Further investigation would be needed to understand the implication for other local government structures.

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Collective insights: skills, capabilities and data

All insights were gathered, collated and categorised under their relevant topics: Skills and capabilities, data, tools, barriers and opportunities. These are outlined over this page and pages 36, and 37.

Skills and Capabilities

- There were a range of maturity levels of all the local authorities spoken to. The engagements encountered:
  - a climate team with dedicated business intelligence staff
  - a separate GIS/data team that operates council-wide that the climate team can request resources
  - a small climate team with limited to no GIS/data capability.
- Majority of stakeholders (58%) are already using GIS/STeM to model Net Zero Data to some degree.
- GIS/data/modelling skills are often seen as only for those with pre-existing qualifications/training and are seldom included in local authority hiring standards or seen as a must-have.

Data

- The interview and survey results suggest a fragmented use of datasets i.e. lack of whole system approach or consistency of usage across local authorities. It was suggested that this is driven by isolated funding streams e.g. EV infrastructure, retrofit schemes etc. that incentivise activity.
- There is a need for the standardisation of strategic planning/Net Zero data to ensure consistency amongst local authorities and interoperability of their local plans with regional plans etc. There was desire for an affordable, accessible data store for strategic planning / Net Zero data.
- A minimum data requirement for a STeM should be set to provide a 'light-touch' approach.

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Collective insights: tools

Tools
• Using GIS/STeM, visualisation models are the most common type of tool utilised (e.g. arcGIS) and focused on system baselining, project identification and feasibility.
• A lack of availability and engagement with pathway and optimisation tools to develop strategy Net Zero plans was observed from the interviews and surveys.
• If complex pathway and optimisation tools were to be introduced into a climate/Net Zero team, there would be a lack of capacity/skill to internally own and operate the model.
• Pathway modelling tools can give greater confidence for funding/investment plans by providing strategic context i.e. the Greater Manchester LAEP informed the spatial plan which led to a detailed heat pump investment plan and ultimately funding.
• In contrast, visualisation, stakeholder engagement, and basic scenario tools could support tactical/operational planning that are invaluable for project delivery.
• Guidance needed on which tool (capability) should be utilised at the different project delivery stages.

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Collective insights: barriers and opportunities

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Barriers
• Lack of funding for internal teams and stretched capacity within the teams. • Access to affordable accurate, up-to-date data (such as network data). • Non-interoperable policies for grants/funding. • STeM outputs are use-case specific, and therefore don't necessarily support all the needs that an organisation may have. For example, currently, LAEP outputs are not updated regularly against local reality/changes and are intended to be a strategic plan.
Opportunities
• Value of spatial planning recognised amongst stakeholders across all engagements. • The Net Zero Hub could be suitable to take on an advisory/coordinator role while not holding the skills, tools and data directly. • Provide a centrally managed service that provides strategic Net Zero planning information in a standardised format. • High interest was demonstrated for the strategic guidance STeM could provide to help inform project delivery and secure funding – as evidenced by stakeholders with completed LAEPs which were able to provide concrete evidence to secure funding. **Note:** Not all STeM is equal in both regards, with pathway models more capable of providing confident evidence for funding and visualisation models more suited to inform tactical project delivery.

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5.
Commercial Market Landscape Assessment

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A structured method was used to identify potential commercially available STeM tools

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To ensure a consistent approach was taken, a structured method was adopted to research different tools. The approach included: development of a functional framework based on needs, establishing a longlist, refining this to a shortlist, and then conducting an expression of interest with promising suppliers.

Develop functional framework

A functional framework was developed based on literature review, and insights from the stakeholder engagement. The purpose of the framework is to describe the different capabilities that tools could support and provide a common definition for assessment.

The functional framework is described in greater detail on pages 39 and 40.

Longlist

A long list of different STeM tools was developed to provide a high-level view of the different tools available and an initial high-level assessment of their capabilities.

The longlist of tools can be found on page 41.

Shortlist

A desk-based review identified the most promising tools from the shortlist, based on their ability to deliver the capabilities within the functional framework. Each of these tools was then assessed against the functional framework that was created.

The shortlist of tools and assessment can be found on page 42.

NOTE: This assessment was conducted based on a desk-based review of the publicly available information.

Expression of interest

The tools that generated the most interest during the short-listing process were then invited to respond to an expression of interest. Respondents were asked to provide a view of what capabilities they can deliver today, and the capabilities that are currently under development.

The insights gathered as part of the expression of interest can be found on page 44.

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A functional framework was devised based on stakeholder insights to assess tools

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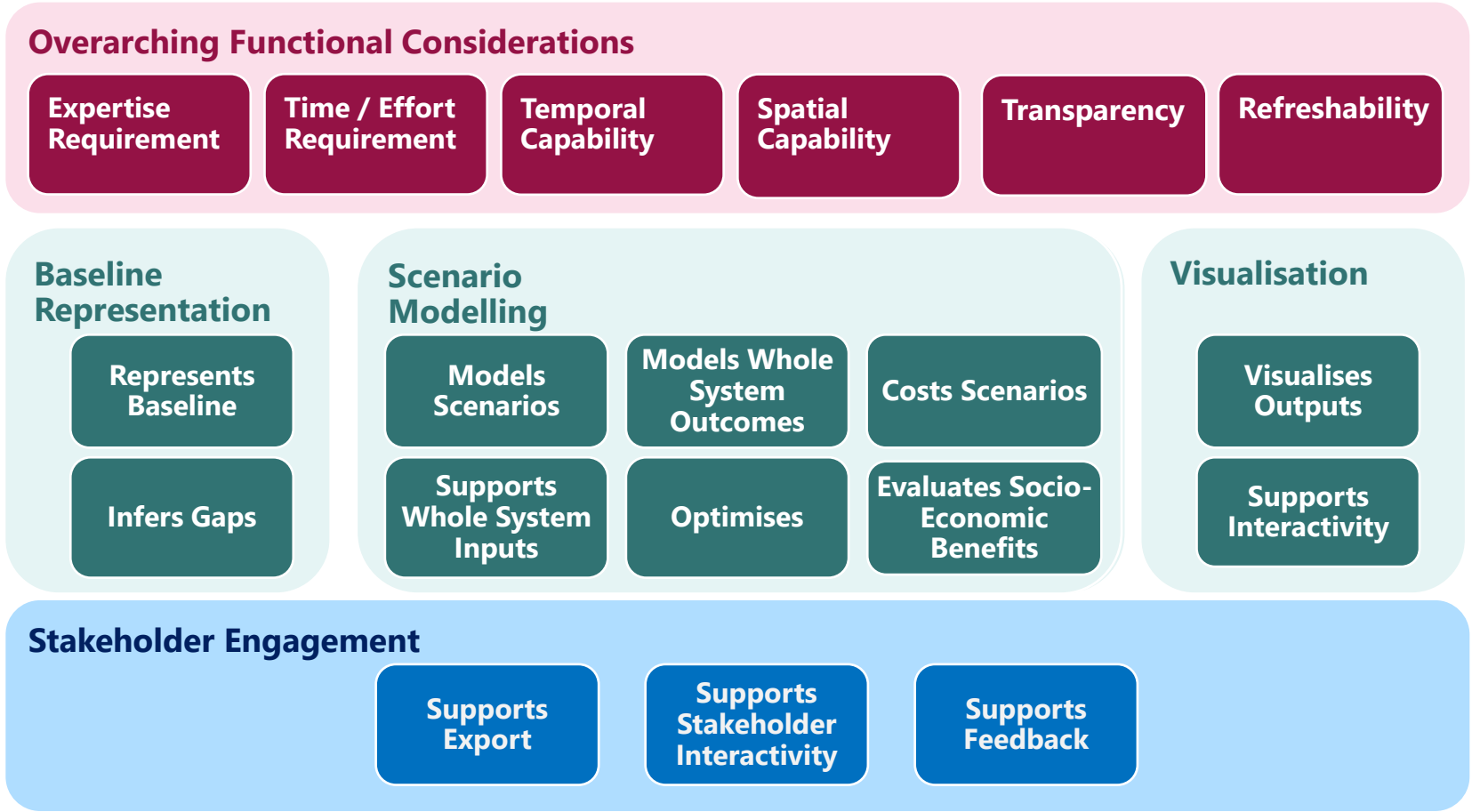
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To have a consistent definition of the different capabilities that STeM tools could offer, a functional framework was developed that articulates the main functions offered that could deliver on the needs of local authorities.

The proposed functional framework has been defined across 5 functional areas:

1. **Overall functional considerations:** These are overall considerations for tools, the outputs they produce, and the robustness of assumptions made by tools.
2. **Baseline representation:** These functions are used to depict the current energy and social system that exists within a place.
3. **Scenario modeling:** These functions relate to the ability of tools to model and create efficient decarbonisation pathways scenarios based on whole system inputs
4. **Visualisation:** These functions relate to the ability to visualise outputs that can be interacted with by stakeholders.
5. **Stakeholder engagement:** These functions relate to the ability to gather input from other individuals and organisations based on a plan.

Each of these functional areas has a series of functions (Depicted in darker colours on the right). Full descriptions of each of the functions are available on page 40.



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Each function within the framework has been given a description

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To fully articulate the capability being delivered by different STeM tools a description has been given to each of the functions presented on page 39

Overarching Functional Considerations

Expertise Requirement - The level of expertise required by the user of the tool
Time/Effort Requirement - The time and/or effort required to successfully use the tool
Temporal Capability - The tool models such that its outputs contain information on how the energy system changes over time
Spatial Capability - The tool models such that the outputs produced can be interpreted spatially
'Refreshability' - Ability of the tool to update the scenarios (or other outputs) it has generated continuously in line with new data or relevant situational changes
Transparency - How able is the user to examine the data and assumptions that underly the model and the results it produces?

Baseline Representation

Represents Baseline - The tool provides a representation of the energy system as it currently exists as a basis to understand the impacts of the changes to be modelled
Infers Gaps - Where there are relevant aspects of the current energy system for which pre-existing data sets are not available, the tool can provide a representation by inferring the missing values. **Note** this is not the same as acquiring a more complete dataset

Scenario Modelling

Models Scenarios - The user can create scenarios by inputting assumptions about how the future system will look and/or by inputting details of specific energy project(s) to be explored
Supports Whole System Inputs - The user is able to alter assumptions around wider aspects of the energy system which may impact the specific aspect(s) being explored
Models Whole System Outcomes - The scenarios include an assessment of the impacts of changes on each aspect of the wider energy system which may be impacted
Optimises - The tool designs an optimised system - usually by minimizing cost - as opposed to relying solely on a set of assumptions for how the future system will look
Costs Scenarios - The scenarios are costed
"Evaluates Socio-Economics Benefits - Provides evaluation of benefits of interventions modelled which are wider than the energy system itself - e.g. job creation, air quality improvements"

Visualisation

Visualises Outputs - The tool produces visualisations of its modelling results, rather than, for example, outputting raw data for user manual interpretation
Supports Interactivity - The visualisations produced are interactive, rather than, for example, static images of maps or graphs

Stakeholder Engagement

Supports Export - The tool's outputs can be exported for dissemination to stakeholders
Supports Stakeholder Interactivity - Stakeholders (as well as the core users of the tool) can interact directly with the tool's outputs, for example with interactive maps
Supports Feedback - There is an embedded capability within the tool for stakeholders to provide feedback on any findings/conclusions

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Long list of tools created during the initial market review

The summary table below outlines example tools that are currently available in the market that were considered for this project. Each could be broadly categorised as either a pathways model, visualisation-focused, or network operator. **To note**, not all tools within each category are equal in terms of capability, output, or robustness, and this list is not exhaustive and will evolve as new offerings are developed.

Category	Name	Owner	Availability	Skill-level	Use-cases
Pathway models	EnergyPath Networks	Energy Systems Catapult	Low	Expert	Multiple LAEPs
	SCATTER	Anthesis and Tyndall Centre	Medium	Non-expert	N/A[1]
	ARUP Local Area Energy Planning	Arup	Low	Expert	Multiple LAEPs
	City Energy Analyst	ETH Zurich	High	Non-expert	Academic research projects
	EVCI Framework	Transport for the North	Medium	Expert	Used by TfN and partners
	City Science	City Science	Low	Expert	Various county Net Zero strategies
	Buro Happold Energy Planning	Buro Happold	Low	Expert	Multiple LAEPs
	Tranzparent	Tranzparent	Low	Non-expert	N/A[1]
	ClimateView	ClimateView	Low	Non-expert	Bristol Climate Hub
	Compass Engine™	Slingshot Simulations	Low	Non-expert	
Visualisation-focused	LAEP+	Advanced Infrastructure	Low	Non-expert	Multiple local authority examples
	IES iCD	IES VE	Low	Non-expert	Calderdale LAEP
	LOCATE SOLAR	Geospatial Insight	Low	Non-expert	N/A[1]
	LOCATE EV	Geospatial Insight	Low	Non-expert	N/A[1]
Network Operators	Your Local Net Zero Hub	UKPN	Medium	Non-expert	Support planning in UKPN's area
	LENZA	SSE	Medium	Non-expert	Support planning in SSENs area
	LHEES NAVI Tool	SP Energy Networks	Medium	Non-expert	N/A[1]
	NPG Open Data Portal	NPG	Medium	Non-expert	N/A[1]

Key for Availability[2]

Low	Commercial product/ Internal use only
Medium	Open with Geographical restriction
High	Open for all

Note:

1. No case studies published online
2. Availability is based on degree of open access to tools

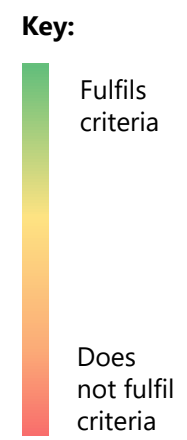
An initial assessment was made against the framework

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Each tool on the short list was scored against the devised functional framework – anonymised results are shown below:

		Tool 1	Tool 2	Tool 3	Tool 4	Tool 5	Tool 6	Tool 7	Tool 8	Tool 9
Overarching Functional Considerations	Expertise Requirement									
	Time / Effort Requirement									
	Temporal Capability									
	Spatial Capability									
	Refreshability									
	Transparency									
Baseline Representation	Represents Baseline									
	Infers Gaps									
Scenario Modelling	Models Scenarios									
	Supports Whole System Inputs									
	Models Whole System Outcomes									
	Optimises									
	Costs Scenarios									
	Evaluates Socio-Economics Benefits									
Visualisation	Visualises Outputs									
	Supports Interactivity									
Stakeholder Engagement	Supports Export									
	Supports Stakeholder Interactivity									
	Supports Feedback									



The visual created when scoring each tool against the framework depicted an important message about the commercial market: whilst many tools scored highly one or a couple of the functional areas, no tool scored highly against every area meaning that **currently there is no tool available that meet all the identified STeM needs** of the local authorities/combined authorities/Net Zero Hubs. Further work is needed to understand which use cases each tool can meet, and how they can interoperate with each other to show how they might be used as part of a wider ecosystem.
To note, this is not meant to be seen as a criticism of the tool tools (especially as some are not trying to score highly for all; instead, focusing on a singular element such as visualisation). However, this does illustrate **the need for (applicable) vendors to work closer with their public sector user groups to develop tools that are able to fully fulfil their operational needs** as well as consciously develop **interoperable products and services** that focus on their specialist offerings.

A selection of vendors were contacted to provide responses to an EOI

Several of the most promising vendors were contacted an Expressions of Interest (EOI) to better understand the extent to which they can deliver the STeM capabilities outlined, future roadmaps, and potential costs to inform future business case development.

Approach

Seven of the most promising vendors researched were contacted to respond to the EOI. Within the EOI vendors were asked:

1. **What capabilities is your tool able to provide today?**
2. **What level of skill is needed to operate it?**
3. **What capabilities will your tool be able to provide in future?**
4. **What is an indicative cost range for the tool?**
5. **Are there any strategic planning examples/projects for which your tool was used?**

The key highlights and observations of this have been highlighted on the right of the page.

Key observations

Functional coverage

The EOI engagement confirmed the observation that there isn't a single tool that can deliver on all the STeM capabilities identified. However, there were several that can deliver many of the capabilities identified as part of a suite of tool offerings.

Use-case Specificity:

Every tool appeared to deliver strong capabilities, but in some cases, this was for niche use cases. For example, forecasting of future EVs and charger siting, and Local Project viability assessment.

Data:

Several of the tools appeared to be bundled with data. Long-term, to ensure interoperability there may be value in a centrally agreed (and funded) data repository (similar to that offered by OS Maps).

Costings:

The different tools had different cost models. These varied from:

1. A flat fee per local authority;
2. user-based licensing for specific capabilities.
3. Free access for English local authorities for a fixed period.

As such, from a cost perspective, the most economically effective solution will depend on the specific use case and intended users of the tool. (For example, a large number of users across the local authority, or a handle of specialist users.)

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6.
Future governance model options

Future governance of STeM requires consideration of the organisational structures

To give an overview, the jurisdictional structure of the Hub, its combined authorities and their local authorities can be seen below:

north east & yorkshire NET ZERO HUB

Combined authorities

Hull and East Yorkshire	West Yorkshire	North East	South Yorkshire	Tees Valley	York and North Yorkshire
East Riding of Yorkshire Hull City	Bradford Calderdale Kirklees Leeds Wakefield	Durham Gateshead Newcastle Northumberland North Tyneside South Tyneside Sunderland	Barnsley Doncaster Rotherham Sheffield	Darlington Hartlepool Stockton-on-Tess Middlesbrough Redcar and Cleveland	North Yorkshire York

Local authorities of each combined authority

The North East and Yorkshire Net Zero Hub is collaboration of six combined authorities and Local Enterprise Partnerships who work with public sector organisations, stakeholders and their communities to deliver Net Zero projects and local energy strategy.

A combined authority is a legal body of two or more local councils. Combined authority models allow for robust collaboration and collective decisions and actions to be made across council boundaries making space for increased ambition and resource.

Local authorities are responsible for the delivery and maintenance of a number of vital services for its residents and local businesses. The bodies house vital, bespoke knowledge of their areas which are often crucial to the delivery of infrastructure and social projects.

To note: the combined authority model is likely to have increased uptake in local governance in England in the future, meaning that the proposed model could be applicable for more areas in the future. Further analysis is needed to explore possible models for the devolved nations.

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Where could different components of a STeM solution sit?

With the insights gathered from the engagements and the considerations of the Net Zero Hubs', combined authorities' and local authorities' individual roles within local governance; the resources available to them and their operational boundaries, the below details where skills, tools and data could potentially be managed.

The Net Zero Hub

Role: Advisor/Co-Ordinator

The Hub's position in the local governance structure grants oversight of its wider area and their collective and interacting need. This combined with its network of relationship and specialised mission of delivering Net Zero projects and considering the limitation of its inability to own assets, would place the Hub in an advisory/co-ordinator role for STeM projects.

Skills/capabilities needed: Stakeholder engagement, project management, sector specific

Data owned: None

Tools used: None

The combined authority

Role: Convenor/Facilitator

A primary feedback received during the stakeholder engagements was that local authorities currently do not have the resources available to own and operate a model. Therefore, with its combined resources and convening role, the combined authorities may be well placed to coordinate action (i.e. owning some shared assets and coordinating STeM exercises). In addition, the combined needs of their local authorities would ensure there is sufficient demand to justify coordinated activity.

Skills/capabilities needed: Modelling expertise, data analysis, data interpretation, sector-specific

Data owned: Collect and provide National/regional datasets that cover multiple local authorities

Tools used: Pathway models, Network operator

The local authority

Role: Delivery

The outcome of the literary findings were clear that a 'place-based' approach will make for the most successful, efficient and economic delivery. Therefore, the local authorities are best placed control and operate the delivery of the individual projects which spur from the STeM conducted.

Skills/capabilities needed: Stakeholder engagement, data collection, delivery coordination/project management.

Data owned: Granular datasets unique to the local authority

Tools used: Visualisation focused tools, Network operator

To note: This view is based on the geography explored in this project (north east of England). Further analysis is needed to explore governance models for wider geographies with different governance structures, as well as the risks associated with the funding structures of different entities.

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7.
Summary and observations

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There is a demonstrable value in STeM for strategic Net Zero planning

The engagement has shown the value the STeM can hold in terms of funding, identifying, and delivering projects. However, there is a broad spectrum of capabilities across different organisations.

There is demonstrable value in local Spatial and Temporal Modelling

There is significant literature published on the value of local view for strategic Net Zero planning that shows that whole system local area planning is the most robust, economic, and can provide greater social value than top-down approaches. However, not all STeM tools serve the same use cases. Pathway models are more capable of providing confident evidence for funding and longer-term strategic plans. Whereas visualisation models are more suited to inform project delivery.

Developing plans and funding are linked and STeM tools can support this

Having a plan and delivering projects are not mutually exclusive; they can influence and inform each other.

There is value in proactively using STeM capabilities to develop plans and proposals, as in some cases funding can then follow.

Local authorities have different levels of capability, but there are quick-wins

Today there are significant limitations with local authorities' resources. However, there are elements of STeM functionality that could be broadly applicable and add value, and it will help authorities to develop and deliver project.

There is a need to think about levelling of assets and skills (What might be suitable for a local authority, combined authority, and Net Zero Hub)

Key observation:

Strategic Net Zero planning can be supported by greater Spatial and Temporal Modelling capabilities which many local and combined authorities showcase at least a minimum level. However, the specific capabilities needed vary on the use-case and stage of journey.

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The stakeholder engagement included interviews, surveys, and workshops.

Through the stakeholder engagement, 26 different local government organisations provided key insights into the current and desired STeM capabilities of local government.

Modular Implementation	Strategic Guidance	Pathway/Scenario Modelling	Solution requirements	Solution Governance
A modular approach to introduce STeM, beginning with the mapping and visualisation of Net Zero and existing pathway data would be beneficial to cater to different needs found across the different local authorities.	STeM, primarily pathway models, can provide valuable strategic guidance to inform project delivery and secure funding/investment.	Limited engagement with pathway/scenario modelling was highlighted across many organisations e.g. local authorities, combined authorities and Net Zero Hubs.	Local authorities saw value in in-house GIS training and tools that do not require third parties/expert-user training. However, such tools are generally currently unable to provide the detail and granularity of a LAEP.	Different levels of local government could own different elements of spatial and temporal modelling. However, based on current analysis there wouldn't be the capability to own, deliver and manage, a complex pathway model within these organisations.

Key observation:

Local and combined authorities have a range of unmet needs when it comes to supporting STeM for strategic Net Zero planning. Notably, there appears to be a lack of awareness of data quality and availability, and the potential impact this could have on a plan.

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The STeM skills, data, tools, and use cases needed vary across strategic planning journey

The STeM needs vary across the strategic planning journey, and therefore the appropriate STeM capabilities will change depending on the activity being undertaken.

Time horizon

	Long-term strategic planning	Annual review of progress and decarbonisation	Project delivery, monitoring and evaluation
	As part of longer-term strategic planning more complex STeM capabilities such as whole-system optimisation are needed to create a pathway of what might happen and provide robust modelling and deliverable decarbonisation plan that also delivers wider social outcomes.	As part of regular progress reviews, there may be the need to view and track progress against a strategic plan. This may include visualisation and representation of local area assets alongside socio-economic data.	Over the shorter term, there are more ad hoc needs to support individual initiatives, monitoring, and evaluation that could be delivered using visualisation and baselining toolkits.
Timescale	**Long-term (updated every 5 years)**	**Semi-regular updates (annual)**	**Short-term (< annual)**
Skills	Data modelling, data analysis, data interpretation stakeholder engagement	Data modelling, data analysis, data interpretation, stakeholder engagement	Stakeholder engagement, project delivery
Tool capabilities (from the functional framework)	Represents Baseline; Models Scenarios; Models Whole System Outcomes; Costs Scenarios; Temporal Capability; Infers Gaps; Supports Whole System Inputs; Optimises; Evaluates Socio-Economic Benefits; Spatial Capability; Supports Export; Supports Stakeholder Interactivity; Supports Feedback	Models Scenarios; Models Whole System Outcomes; Costs Scenarios; Visualises Outputs; Refreshability; Supports Whole System Inputs; Optimises; Evaluates Socio-Economic Benefits; Supports Interactivity; Spatial Capability; Supports Export; Supports Stakeholder Interactivity; Supports Feedback	Visualises Outputs; Refreshability; Supports Interactivity; Spatial Capability; Supports Export; Supports Stakeholder Interactivity; Supports Feedback
Outcome	Strategic plan	Update baseline	Inform individual project delivery
Data	Baseline data, broader energy system data	Local data recently updated	Local data recently updated

Key observation:

STeM needs will change depending on where organisations are in the journey and data, tools, and skills should be tailored accordingly. A modular approach to STeM tools and capabilities can help local authorities to develop and deliver Net Zero plans. Pathways optimisation and modelling capabilities may set the strategic direction and visualisation tools are more suitable for project delivery.

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The capabilities of the STeM involve developing decarbonisation pathways.

The functional framework captures the different STeM capabilities that are needed to develop decarbonisation pathways. These were developed to help create a set of criteria to assess prospective commercial propositions against.

- STeM has a range of capabilities covering **baseline representation**, **modeling scenarios**, **visualisation,** and **stakeholder engagement**. There is value in building these capabilities over time as there may be quick wins for less mature organisations.
- There are tools available across all areas of the functional framework that can deliver on the needs. **However, no one tool can deliver all the capabilities outlined.**
- As a result, the **most appropriate tool will depend on the use case** and **when the tool is being** used in the planning lifecycle.
- Modularity of solutions based on the maturity and scope of the local authority.

Functional framework

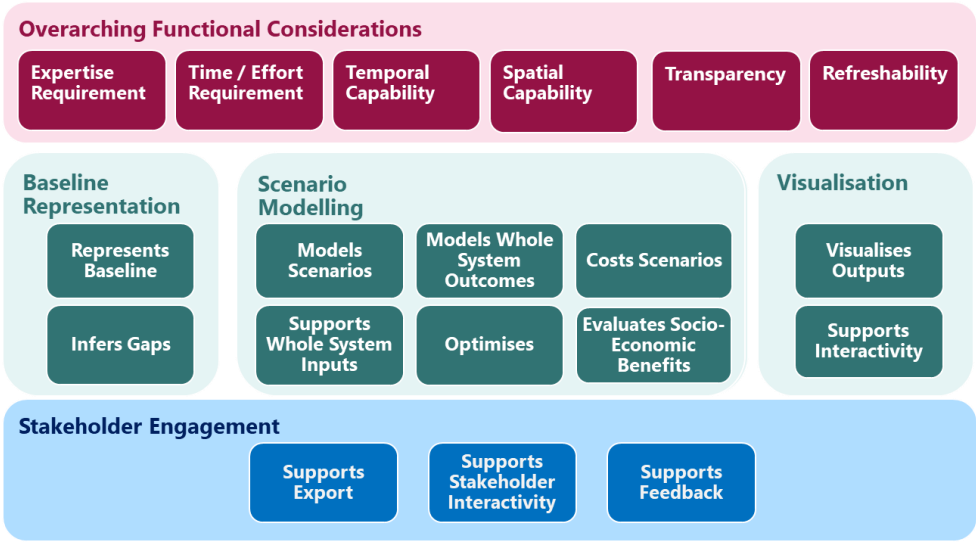


Image: STeM functional framework

Key observation:

The functional framework captures the breadth of scope needed from a tool to support different STeM use cases at different journey stages. These range from advanced whole-systems pathway creation as part of a LAEP process, to tactical visualisation for project delivery.

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A selection of vendors were contacted to provide responses to an EOI

Several of the most promising vendors were contacted an Expressions of Interest (EOI) to better understand the extent to which they can deliver the STeM capabilities outlined, future roadmaps, and potential costs to inform future business case development.

Approach

Seven of the most promising vendors researched were contacted to respond to the EOI. Within the EOI vendors were asked:

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Skills, tools, and data can be owned by different local government organisations

Different local government organisations (e.g. Net Zero Hubs, combined authorities, and local authorities) could host different STeM capabilities to make best use of their convening power, geographic coverage and funding models.

The Net Zero Hub

Role: Advisor/Co-Ordinator

The Hub's position in the local governance structure grants oversight of its wider area and their collective and interacting need best places the Hub in an advisor/co-ordinator role for STeM projects.

Skills/capabilities needed: Stakeholder engagement, project management, sector specific

Data owned: None

Tools used: None

The combined authority

Role: Owner/Operator

The stakeholder engagements found that local authorities currently do not have the resources to do own and operate a model. Therefore, with its combined resources and convening role, the combined authorities are best placed to do so.

Skills/capabilities needed: Modelling expertise, data analysis, data interpretation, sector-specific

Data owned: Collect and provide National/regional datasets that cover multiple local authorities

Tools used: Pathway models, Network operator

The local authority

Role: Delivery

The outcome of the literary findings were clear that a 'place-based' approach will make for the most successful, efficient and economic delivery. Therefore, the local authorities are best placed control and operate the delivery of the individual project.

Skills/capabilities needed: Stakeholder engagement, data collection, delivery coordination/project management.

Data owned: Granular datasets unique to the local authority

Tools used: Visualisation tools, Network operator

Key takeaway:

There is an opportunity for different levels of local government to collaborate and share resources to support Spatial and Temporal Modelling

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