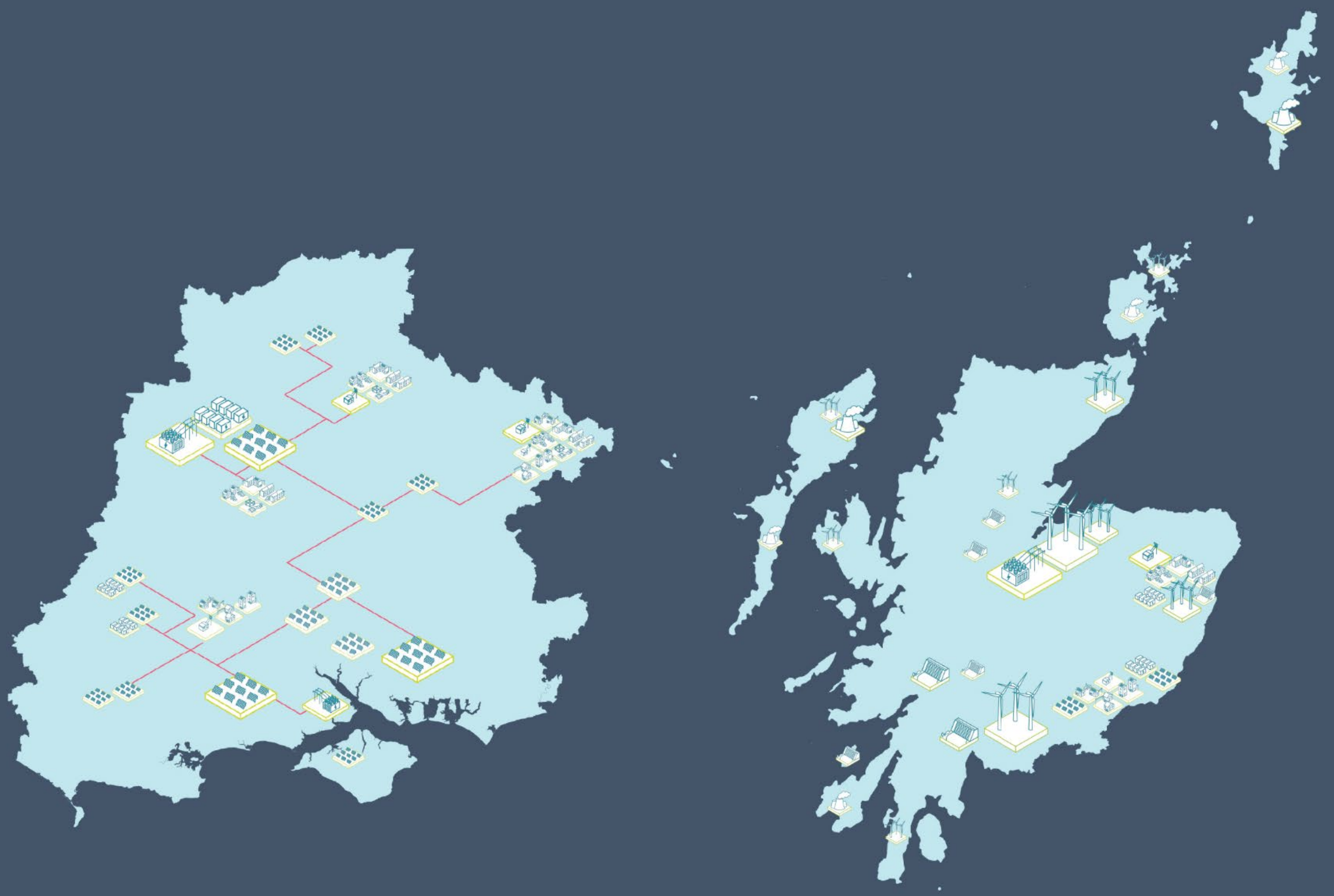
Distribution Future Energy Scenarios 2024

Introductory report for the Southern England and North of Scotland licence areas



regen transforming energy

Scottish & Southern Electricity Networks
DSO Powering Change

About SSEN Distribution

Scottish and Southern Electricity Networks (SSEN) Distribution is the electricity Distribution Network Operator (DNO) responsible for delivering power to 3.9 million homes and businesses across the north of Scotland and central southern England. With over 5,000 employees across the country, we manage and maintain over 128,000km of overhead lines and underground cables, alongside 460km of subsea cables which power our island communities.

We're working to get more people and projects connected to a growing electricity system. We're accelerating our Distribution System Operations (DSO) capabilities, enabling the delivery of local smart grids and flexibility services across our licence areas, while facilitating the uptake of low-carbon technologies such as electric vehicle (EV) charging and domestic heat pumps. Our approach is tailored to local needs, to drive a just and fair transition, advising and guiding our customers and stakeholders in coordination with local communities.

About Regen

Regen is an independent centre of energy expertise with a mission to accelerate the transition to a zero-carbon energy system. We have nearly 20 years' experience in transforming the energy system for net zero and delivering expert advice and market insight on the systemic challenges of decarbonising power, heat and transport.

Regen is also a membership organisation, managing the Regen members network and the Electricity Storage Network (ESN) – the voice of the UK storage industry. We have over 150 members who share our mission, including clean energy developers, businesses, local authorities, community energy groups, academic institutions and research organisations across the energy sector.

Acknowledgements

We would like to express our sincere appreciation to all those who contributed to the successful completion of this report.

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Prepared by	Christine Chapter, Head of Delivery
Approved by	Ray Arrell, Associate Director
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Foreword

SSEN has a critical role in facilitating the decarbonisation of the UK. The communities we serve depend on us to deliver a safe, reliable supply of electricity to their homes and businesses so they can thrive today, while we work to deliver the infrastructure to create a net zero tomorrow. This means readying our network for the uptake of low-carbon technologies such as EVs, heat pumps and local renewables, which will need smart connections to be able to interact with the grid.

Through 2024 we have transformed our approach to strategic development of our distribution networks through publication of our Strategic Development Plans (SDPs) and associated methodology. Our SDPs provide recommendations to meet future projected capacity requirements out to 2050 for our complete network and will be refreshed annually.

This approach is essential to allow SSEN and our customers to respond to major initiatives within the energy industry, such as Clean Power 2030 and the introduction of Regional Energy Strategic Plans (RESPs). Our plans will also inform our approach to the next electricity distribution price control period, ED3, which will start in April 2028.

The work that Regen has undertaken here, and for previous reports, is the bedrock for our strategic plans. Our future proposals draw on Distribution Future Energy Scenarios (DFES) figures to establish the building blocks that must be in place to facilitate net zero.

Your input and involvement in this process are essential to help us appropriately identify and develop the local electricity systems and grids of the future. Regen has engaged with many of you in the development of this year's DFES and I would like to thank you for your time and effort. But our engagement does not stop here. Through innovative tools such as the Local Energy Net Zero Accelerator (LENZA) and consulting widely on our strategic plans, we want to engage with local authorities and other stakeholders throughout the year, to understand your needs and share our plans as they develop.

Central to this is our commitment to a just transition that leaves nobody behind. Last year we asked Regen to investigate more deeply how the transition to net zero is affecting vulnerable consumers, and how DFES can help us understand these impacts and suggest ways to ensure no customers are left behind. We've taken Regen's recommendations and applied their findings to our strategic development process. This will help us prioritise future upgrades to the more vulnerable communities in our licence areas.

Finally, I would like to thank Regen for their work on the latest DFES and to thank all our stakeholders, particularly local and regional authorities, for their ongoing engagement and contributions to our research. We look forward to continuing to work closely with you through 2025 and beyond.

Andrew Roper

Distribution System Operations Director

Scottish and Southern Electricity Networks

Section 1: Introduction

This report provides the background, framework and context for the 2024 iteration of the DFES analysis for SSEN, covering both the North of Scotland and Southern England licence areas. In addition to this document, separate accompanying technical reports detailing the specific technology sector scenario analyses and outcomes can be found online:

- Forecasting Future Needs of the Network - SSEN

The DFES analysis produces high-granularity forecasts for the growth and reduction of electricity generation, demand and storage technologies connecting to SSEN's electricity distribution network. Underpinning the DFES analysis is the National Energy System Operator's (NESO) Future Energy Scenarios (FES) framework.[1] Published annually, the FES framework outlines different scenarios for the future of the whole energy system. The overarching assumptions that define these scenarios are integral to the DFES analysis. DFES builds on the FES scenarios by engaging a diverse and expert range of stakeholders, undertaking detailed investigations into the pipeline of projects seeking to connect, and reflecting extensive industry and local area insight to forecast future load on SSEN's network. The DFES analysis also informs future iterations of the FES.

At a regional level in England, and a national level in Scotland and Wales, NESO is also working with local authorities, DNOs and communities to develop 'bottom-up' plans to help forecast future energy needs, based on each area's vision for industry, homes and transport. Brought together, this information will create RESPs which will recommend the best future energy mix for each nation and region and ensure they align with 'top-down' strategic plans such as the Strategic Spatial Energy Plan (SSEP) and the Centralised Strategic Network Plan (CSNP). SSEN's DFES analysis will be a critical input to that process.

SSEN use the DFES analysis as part of an integrated network planning, optioneering and investment appraisal process. The DFES projections enable SSEN to model changes to future electricity demand across the network and subsequently assess where network improvements are needed to ensure the capacity is available to meet future demand and deliver government ambitions for both Clean Power 2030 and net zero by 2050. This year's DFES will be a key component of SSEN's next regulatory price control submission (RIIO-ED3, which starts in 2028), identifying the strategic choices that will need to be funded to support the transition to clean power and maintain grid resilience.

This introductory DFES report summarises the DFES methodology used to produce the technology forecasts, the stakeholder engagement that was undertaken to inform the analysis and an overview of the policies and governance that have influenced the analysis.

Section 2: DFES methodology

The DFES analysis projects the capacity of key technologies that are connected to the network, including electricity generation and storage technologies as well as major sources of electricity demand, and how these might change in the future.

2.1. DFES building blocks

The DFES methodology comprises five key building blocks:

Table 1 DFES methodology building blocks

DFES methodology building blocks		
1		The **energy technologies** (generation, demand and storage) that are in scope for the DFES scenario modelling.
2		The **FES framework** that defines the different scenarios for the future of the whole energy system, as well as the overarching socio-economic and technological assumptions behind each.
3		The **stakeholder engagement, industry insight and local knowledge** that informs the DFES modelling.
4		The DFES **modelling and analysis** that is undertaken for each technology in scope, to develop the projections for each FES scenario.
5		The **spatial (or geographical) distribution** of each technology projection to sub-regional, 11 kV or local LV levels. The objective of this step is to project where the demand on the network might change by assigning a geographic location and network voltage level connection to each technology projection. Typically, a local LV network supplies a residential street whereas an 11 kV network can supply a village or neighbourhood.

2.2. Technologies in scope

The DFES analysis includes key technologies and sources of electricity demand that connect directly to SSEN's electricity distribution network assets. It does not include technologies that connect to the transmission network. These technologies and load sources can be classified as electricity generation technologies, storage technologies and future sources of electricity demand.

Table 2 Technologies in scope for DFES 2024

Technology class	Description
Electricity generation technologies	• **Renewable energy generation technologies:** solar PV, onshore wind, offshore wind, hydropower and marine • **Waste and bio-resource electricity generation technologies:** biomass, landfill gas, sewage gas and anaerobic digestion from food waste and other feedstocks • **Fossil fuel electricity generation technologies:** diesel and natural gas-fuelled generators • **Hydrogen-fuelled electricity generation**
Electricity storage technologies	• **Battery storage:** Grid-scale, commercial and domestic battery storage asset classes • **Liquid Air Energy Storage (LAES), also referred to as cryogenic energy storage:** demonstrator-scale LAES plants connecting to the distribution network
Future disruptive sources of electricity demand	• **Electric vehicles (EVs)**: cars, vans, motorbikes, LGVs, HGVs and buses • **EV chargers**: on-street for domestic properties, off-street by domestic properties, car parks, destination, workplace, fleet/depot, en-route local and en-route national • **Electricity-fuelled heating and cooling technologies:** air source and ground source heat pumps, hybrid heating, direct electric heaters and domestic air conditioners • **Hydrogen electrolysers** • **Data centres** • **New properties:** strategic housing developments and new commercial and industrial developments

2.3. The FES framework

NESO publishes the FES framework annually.[1] The 2024 edition outlines three new scenarios (**Holistic Transition**, **Electric Engagement** and **Hydrogen Evolution**) that achieve net zero by 2050 against a **Counterfactual**. Previous editions of the FES also presented three net zero scenarios (Consumer Transformation, System Transformation and Leading the Way), alongside a scenario that did not meet the UK's net zero targets (Falling Short). However, the new FES framework is more focused, and the 2024 scenarios have evolved to present a narrower range of strategic options to decarbonise the UK's energy system.

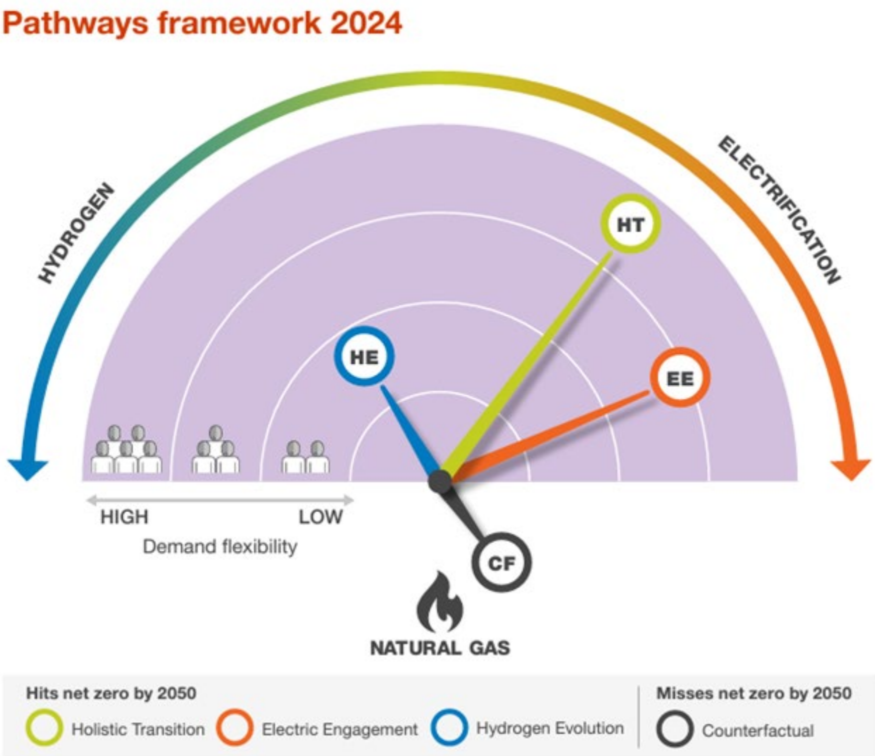

Figure 1 The FES scenario framework (source: NESO)

The DFES uses the FES as the overarching scenario framework, adopting the same system and technology-specific assumptions that define each of the FES scenarios. These assumptions are combined with regional and local factors to develop high-granularity forecasts for SSEN's licence areas down to individual substation-level scenario projections. This approach allows the DFES analysis to recognise and reflect that electricity generation, demand and storage could develop in different ways, and at different paces, in each of SSEN's licence areas.

The FES also provides technology and sub-technology building block definitions and national and (where available) regional projections. The DFES uses these for consistency, comparison and reconciliation. Where FES 2024 Grid Supply Point (GSP) projection data is available, the DFES is reconciled at a licence area level. Where regional technology building blocks were not available, or not directly comparable to DFES due to sub-technology classifications, national FES projections have been used instead for a higher-level reconciliation.

The accompanying technical reports for each of SSEN's licence areas detail the scenario results and variances for each technology in the DFES, as well as the results of the reconciliations to FES GSP data and analysis of any variances identified.

2.4. The DFES analysis method

For each of the technologies in scope, the DFES analysis comprises four key steps:

1. **Historic deployment** and the **existing baseline** of operational or connected projects are determined. DFES 2024 defines the baseline year as the end of the 2023 calendar year.
2. The **near-term pipeline of projects that are in development** is assessed by reviewing projects with either accepted network connection offers or live planning applications registered with local authorities. Most technologies have strong evidence and certainty of near-term development which results in a narrow projection range over this time period.
3. **Medium- and long-term projections** are then modelled under each scenario out to 2050 for the licence area. Typically, a much wider variation can be seen across the four scenarios over this time period, as many of these projects are not yet in development and a range of future policies are reflected. This results in a widening of projected outcomes by 2050 for most technologies across the four scenarios.
4. The licence area level projections are then **spatially distributed** across SSEN's licence area to specific substation areas as either megawatts (MW) of capacity (e.g. onshore wind) or number of units (e.g. heat pumps).

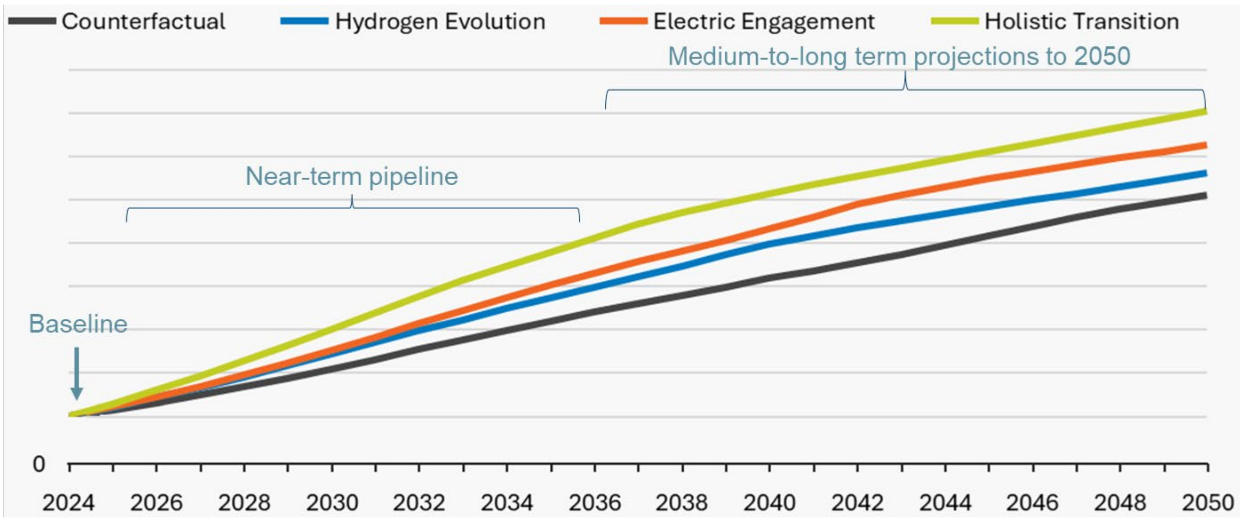

Figure 2 Illustrative stages of the DFES scenario analysis method (source: Regen)

2.4.1. Spatial distribution

The final stage of the DFES analysis is a distribution of the total licence area projections for each technology to Electricity Supply Areas (ESAs). An ESA is a local, geographic zone representing a block of demand or generation that shares upstream network infrastructure. These granular DFES forecasts are then used by SSEN's network planning teams to inform future network investment at specific locations. DFES projections have been designed with the ability to aggregate the forecasts to support network analysis at higher voltage levels or to support local energy planning at the local authority level or other regional boundaries.

ESAs vary in size across SSEN's two licence areas and tend to be smaller in areas of high population density. For example, ESAs in urban areas might equate to the size of a small urban borough, whereas ESAs situated in rural areas cover a much larger geography.

Large generation and storage technology projections are distributed to 418 individual 11 kV primary ESAs in the North of Scotland and 442 individual 11 kV primary ESAs in Southern England. Smaller-scale technologies, including heat pumps, EV chargers and domestic solar PV, are distributed to 49,989 secondary substation ESAs in the North of Scotland and 49,783 secondary substation ESAs in Southern England.

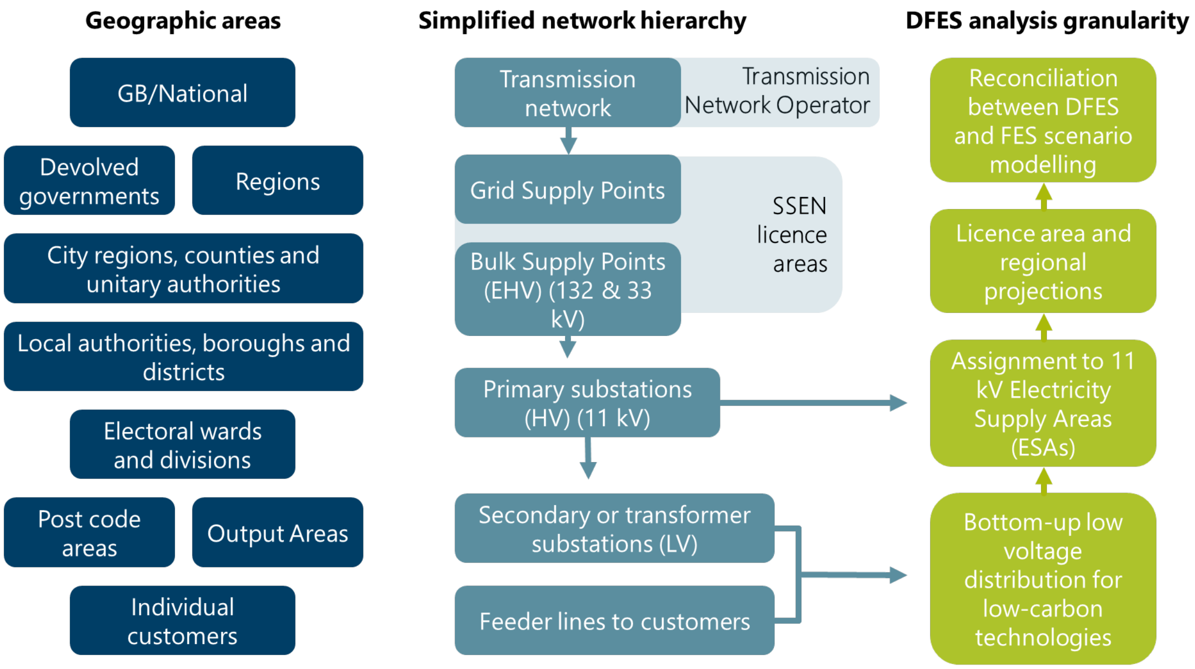

Figure 3 Network hierarchy (and associated geographic area) that determines the granularity of DFES spatial distribution to ESA

The scenario projections for high-capacity generation and storage technologies (for example, onshore wind, fossil fuel generation, large-scale battery storage, etc) are distributed to 11 kV primary substation level. The scenario projections for low-carbon demand technologies (for example, EV charger capacity, domestic heat pumps, rooftop PV, etc) are distributed to either secondary substations or individual LV feeder lines serving small groups of customers which roughly corresponds to a postcode or street level.

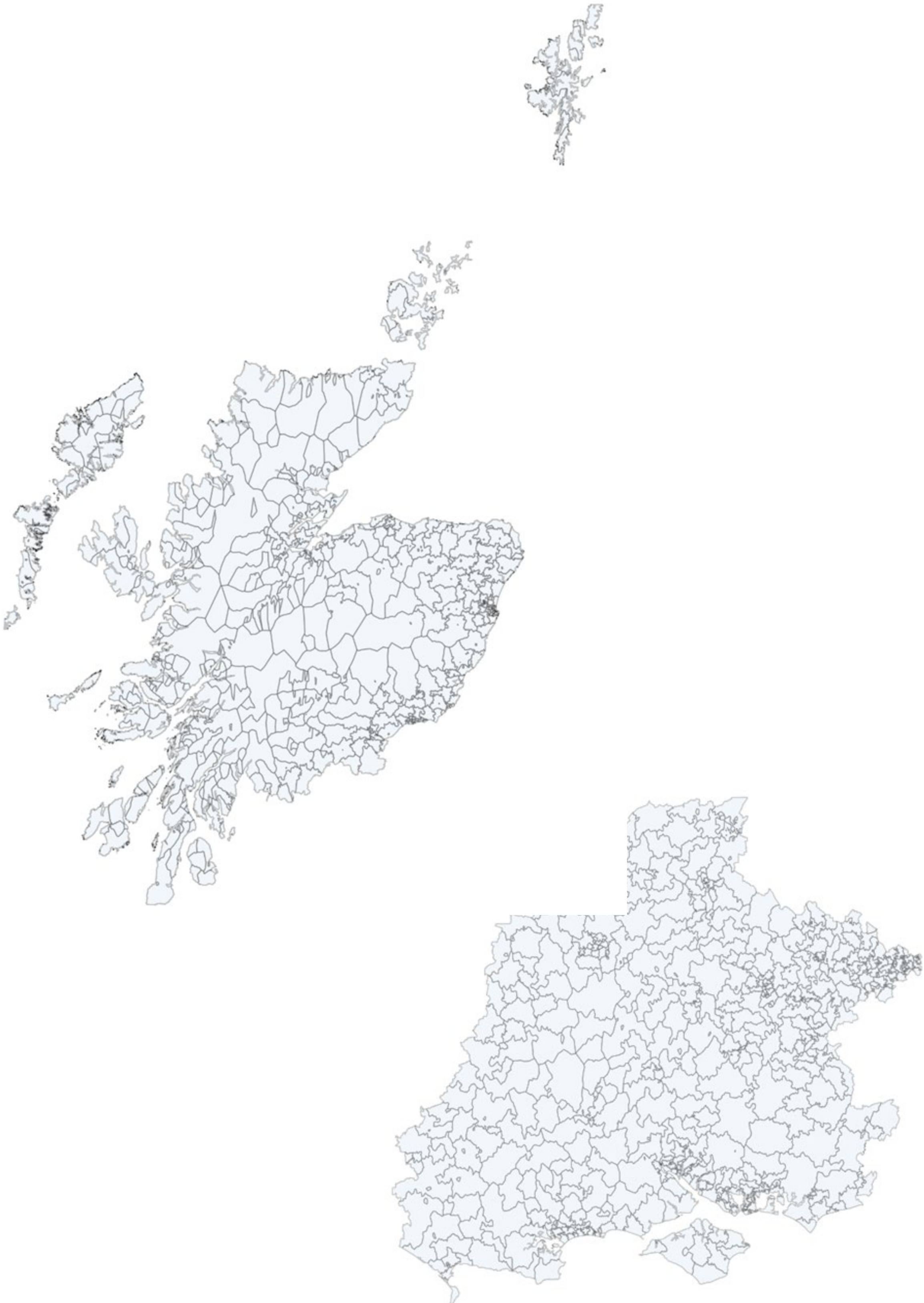

Figure 4: A map showing the 11 kV ESAs in the North of Scotland and Southern England licence areas (source: Regen)

2.4.2. Spatial distribution factors

To complete the spatial distribution of the licence area projections to ESAs, the DFES analysis uses specific technology and locational factors to model the future demand on SSEN's network at a local level.

For example, the DFES domestic EV model integrates several spatial distribution factors to facilitate a street-by-street forecast for the growth in EV ownership. To do this, the key spatial distribution factors for domestic EVs include:

- The number of vehicles per household (sourced from Census data)
- Affluence levels (sourced from Census data)
- Type of vehicles (sourced from Department for Transport data)

Similarly, Regen's heat model uses EPC and Census data as spatial distribution factors. Each of the buildings in a feeder area is categorised into one of approximately 30 building archetypes, based on a combination of existing heating technology, building type, tenure, construction age (used as a proxy for energy efficiency) and potential for district heating. This enables the development of scenario projections for each of the building archetypes, projecting the likely conversion from the current heating technology to a heat pump, district heat connection or resistive electric heating.

The spatial distribution factors for each of the technologies included in the DFES analysis are based on a wide range of national and regional datasets, feedback and local insight from extensive stakeholder engagement, and the ambitions and targets of local authorities.

A summary of the spatial distribution factors used for each technology is included in the technology chapters in each of the technical licence area reports.

2.5. Key DFES assumptions and uncertainties

As can be seen in Figure 2, most technology projections are much narrower in the near term than in the medium and long term. Near-term DFES projections are heavily based on known projects that are in the development pipeline, which are researched and evidenced using SSEN's connections database, national and local planning portals, Capacity Market auction registers and direct engagement with project developers, sector representatives and other regional and national stakeholders.

Over the medium and long term, the pipeline of projects is much less clear as many are not yet in development. Therefore, the DFES projections rely more heavily on the underlying systemic, technological and societal scenario assumptions, defined for each technology in the FES framework and supplemented by relevant regional and national policies.

The key underlying assumptions behind the 2024 DFES analysis include:

- Distributed renewable energy generation capacity will continue to significantly increase in all scenarios, more so in the net zero scenarios
- Unabated fossil fuel electricity generation will decline in all scenarios, more rapidly in some locations than others
- The shift to decentralised energy generation assets will continue (to some degree)
- The electrification of transport is already in progress and will continue to accelerate

- The electrification of heat through the deployment of heat pumps in homes and businesses will increase. Some uncertainty remains over the role that hydrogen boilers and heat networks could play in some areas, especially in hydrogen innovation zones.
- Further energy efficiency deployment will take place in homes and businesses
- Low-carbon hydrogen will begin to be produced and could play a key role in decarbonising industrial processes and some forms of transport, but the scale and location of hydrogen production and use are unclear.

There are also several fundamental uncertainties associated with undertaking scenario projections for a broad range of technologies and sources of demand. These include:

- The range of different outcomes assumed across the FES 2024 scenario framework
- Evolving energy policy from national, devolved, regional and local government
- Commercial markets and financial uncertainties (e.g. investor appetite)
- Technology development, efficiencies, cost reductions and capability
- Consumer adoption of low-carbon technologies and level of flexible behaviour
- Evolving local factors and local ambition around energy and decarbonisation
- The balance of transmission vs distribution network connections
- Uncertainties related to international markets and impacts of global conflicts.

The technology-specific assumptions and uncertainties that have played a key role in the DFES analysis can be found in the technology chapters in each of the DFES technical reports.

2.6. Large-scale battery storage projections

The pipeline of battery storage projects with connection offers across the UK continues to grow significantly, with sites totalling 25.1 GW now evidenced across SSEN's two licence areas.

Table 3 Pipeline of battery storage projects in SSEN's licence areas

Licence area	Pipeline				
	DFES 2020	DFES 2021	DFES 2022 *Incl. quote issued*	DFES 2023 *Incl. quote issued*	DFES 2024 *Incl. quote issued*
Southern England	0.8 GW	1.6 GW	5.3 GW	8.2 GW	16 GW
North of Scotland	0.3 GW	0.4 GW	4.2 GW	7.8 GW	9.2 GW
SSEN total	**1.1 GW**	**2 GW**	**9.5 GW**	**16 GW**	**25.1 GW**

Previous iterations of the DFES analysis included a fifth scenario, named 'Storage Planning'. Unlike the other four FES scenarios, this scenario did not aim to present a credible projection of development within SSEN's licence areas. Instead, it illustrated the potential demand on SSEN's network if all battery storage sites with existing connection offers were to connect. It was primarily developed to highlight the unprecedented scale of the battery storage pipeline when compared to the other DFES technologies.

However, in reality, not all projects in the pipeline will progress to construction and commissioning, even if they hold connection offers, due to financial challenges, planning barriers and potential future grid connection policy reforms. Additionally, the publication of the *Clean Power 2030 Action Plan* in December 2024 further confirmed that not all battery storage projects in the pipeline will proceed.[2] The plan sets a nationwide target of 23 – 27 GW of battery storage by 2030 and acknowledges that the battery connection queue is currently oversubscribed. As a result, the four DFES scenarios provide a realistic outlook on future battery storage connections and the Storage Planning scenario is now redundant.

For each of the four DFES scenarios, the proportion of battery storage projects in the pipeline that are modelled to connect is shown in Table 4. This is partly based on where each project was found to be in the planning process (for example, application submitted, pre-panning, etc). However, other factors also influence whether a site is modelled to connect under each scenario, including the site's scale, business model, co-location details and participation in Capacity Market auctions.

Table 4 Proportion of battery storage projects modelled to connect according to FES scenario and current planning status

	Granted and/or under construction		Application submitted		Pre-planning		No information	
	Licence area		Licence area		Licence area		Licence area	
	Southern England	North of Scotland	Southern England	North of Scotland	Southern England	North of Scotland	Southern England	North of Scotland
Holistic Transition	100%	96%	12%	100%	4%	2%	1%	2%
Electric Engagement	97%	95%	12%	4%	4%	2%	1%	2%
Hydrogen Evolution	95%	91%	0%	0%	0%	0%	0%	0%
Counterfactual	76%	73%	0%	0%	0%	0%	0%	0%

Section 3: Stakeholder engagement

Stakeholder engagement and regional and local input are cornerstones of the DFES analysis. Although based on the national FES framework, the DFES analysis relies on a diverse range of input from stakeholders and methods of engagement, to build regional, sub-regional and local knowledge and insight that inform the DFES modelling assumptions and resultant projections.

3.1. Stakeholder engagement building blocks

Stakeholder engagement for the DFES analysis comprises six key building blocks:

Table 5 DFES stakeholder engagement building blocks

DFES stakeholder engagement building blocks		
1		**Interactive online webinars** where a broad range of stakeholders were asked for their views on the future of energy technology sectors in each licence area.
2		A dedicated **online workshop with representatives from Scottish Government**, exploring devolved energy policies that should inform the DFES modelling for the North of Scotland licence area.
3		An **online data exchange for new domestic and non-domestic developments** where local authority planning teams shared plans for new property developments in their areas.
4		A **local energy strategy survey** for local authorities, to provide information about local policies and plans around renewable energy, heat, transport, waste collection and other key local energy policies.
5		A review and reconciliation of technology targets published in **Local Area Energy Plans (LAEPs)** and, in Scotland, **Local Heat and Energy Efficiency Strategies (LHEES)**.
6		Informal **interviews** were conducted with technology-, industry- and sector-specific stakeholders.

3.2. Licence area webinars

An interactive online webinar was held for each licence area in October 2024, bringing together representatives from local authorities, community energy groups, project and technology developers and other sector-specific representatives. The objective of these sessions was to:

- Provide stakeholders with a summary of the background, method and purpose of the DFES and share how SSEN uses DFES to inform network infrastructure planning
- Tap into regional and local sector knowledge, insights, plans, projects, initiatives and ambitions relevant to each licence area
- Road-test assumptions for specific technology sectors and gather quantitative and qualitative stakeholder feedback on technology capacity growth and locational distribution factors determining the scenario projections
- Capture stakeholder views on broader industry and technology-specific trends
- Discuss views and insights on new or disruptive future technologies and how they may impact the electricity network in each licence area.

Alongside an introduction from SSEN and a brief overview of the DFES methodology, the webinar content was centred around a deep dive into each of the three DFES technology categories: electricity generation, storage and flexibility technologies, and energy demand.

- Onshore wind and large-scale solar PV were the focus of the electricity generation technology category in each licence area
- In the energy storage and flexibility section, the future of battery storage in each licence area was presented, alongside a focus on fossil fuel generation for Southern England and hydrogen electrolysis for the North of Scotland
- For energy demand, the content of both webinars focused on EVs and heat pumps.

For each technology, an overview of the current policies influencing deployment in the licence area was presented alongside a summary of the DFES 2023 projections. The online polling platform Mentimeter was used to capture quantitative and qualitative feedback to a series of technology-specific questions presented to the stakeholders. This feedback formed a crucial input to validate and fine-tune specific aspects of the DFES modelling assumptions for regional uptake projections and spatial distribution factors.

Recordings of both webinars, alongside the presentation materials and the stakeholder feedback provided, can be found here for the Southern England licence area webinar and here for the North of Scotland licence area webinar.

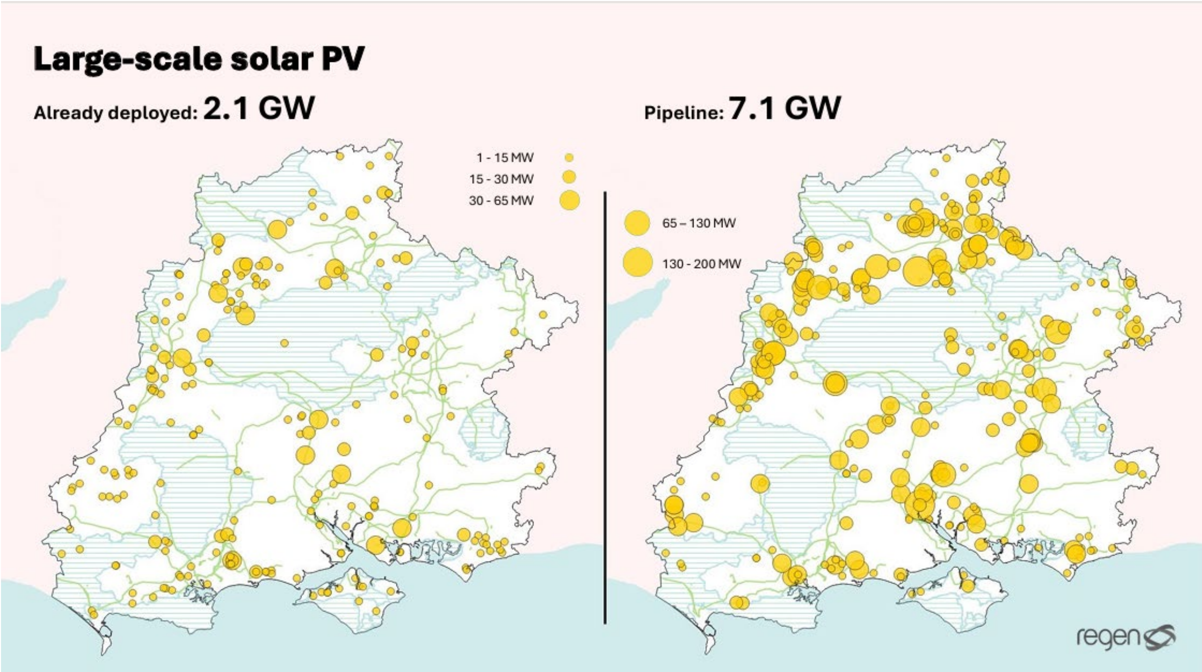

Figure 5 Extract from the Southern England webinar showing the baseline and pipeline of large-scale solar PV projects (source: Regen)

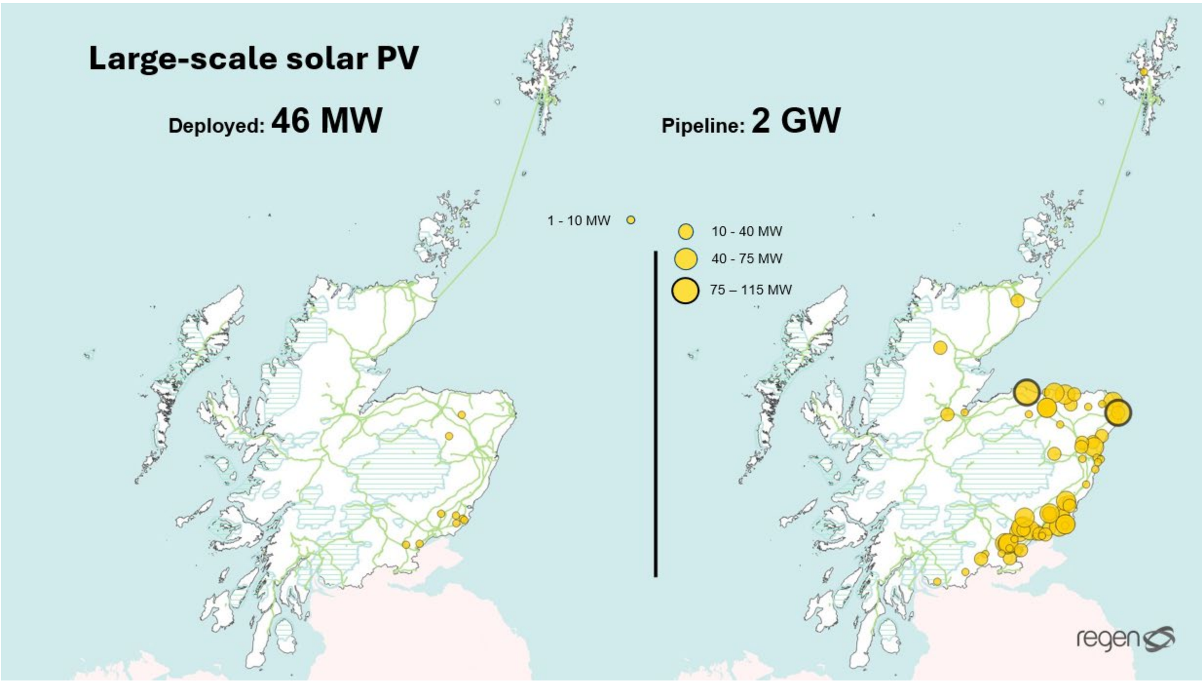

Figure 6 Extract from the North of Scotland webinar showing the baseline and pipeline of large-scale solar PV projects (source: Regen)

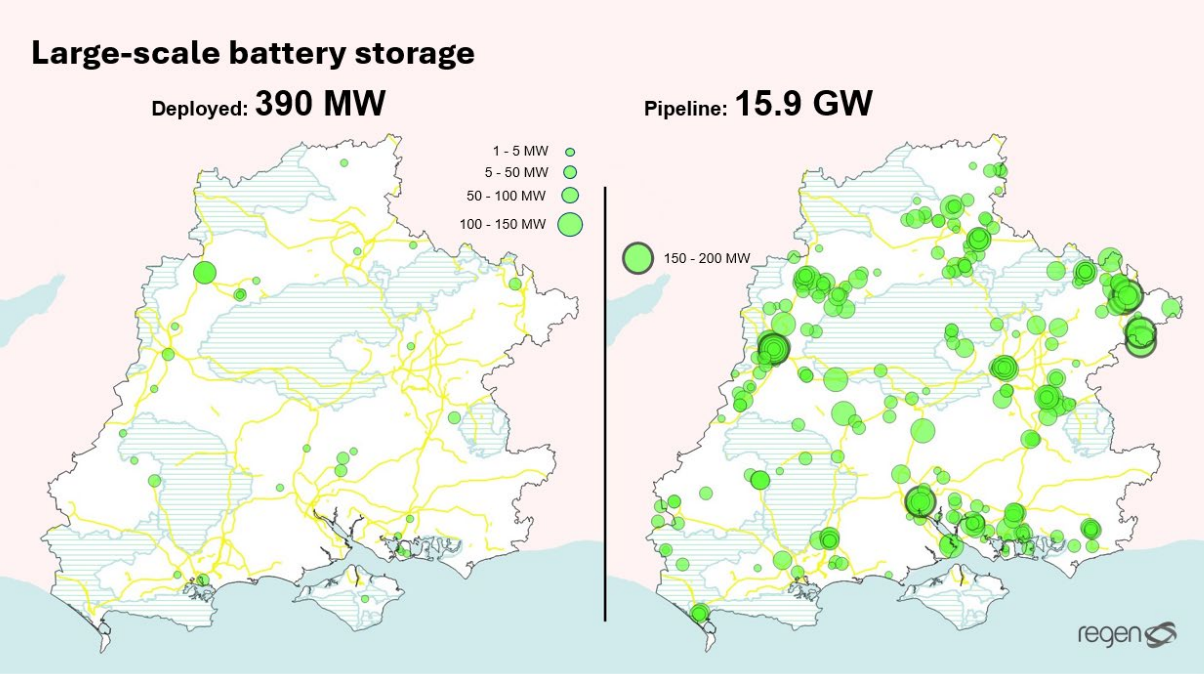

Figure 7 Extract from the Southern England webinar showing the baseline and pipeline of large-scale battery storage projects (source: Regen)

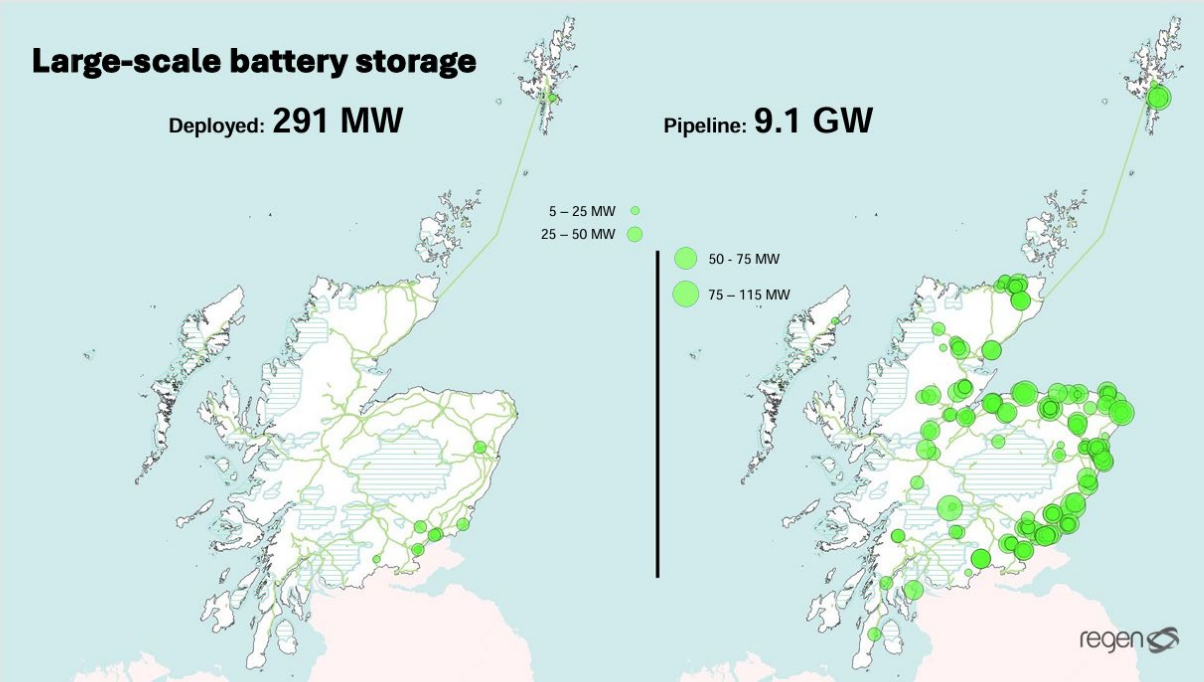

Figure 8 Extract from the North of Scotland webinar showing the baseline and pipeline of large-scale battery storage projects (source: Regen)

3.2.1. Stakeholder representation

The Southern England regional webinar convened 54 stakeholders, while the North of Scotland webinar hosted 29 stakeholders. Both webinars were attended by a diverse range of industry representatives, as seen in Figure 9 and Figure 10.

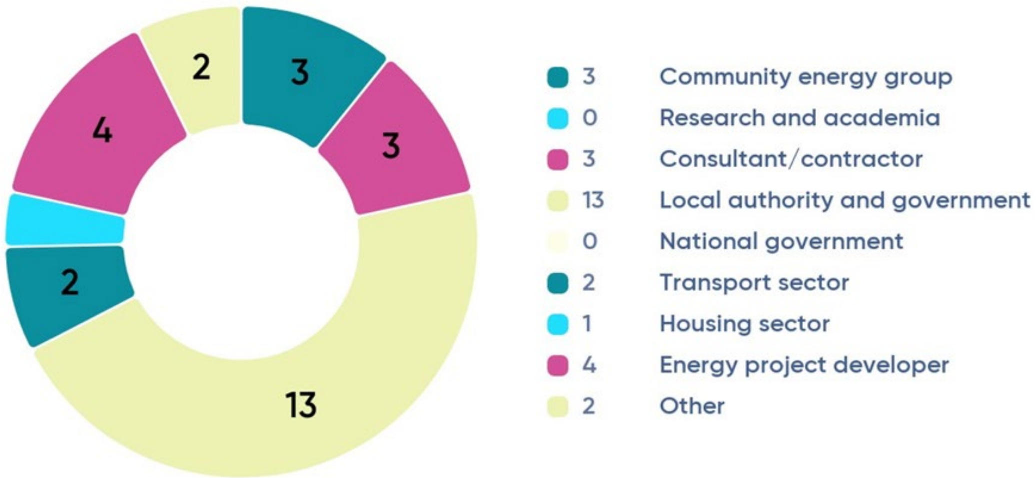

Figure 9 Extract from the Southern England regional webinar showing the industry sector of stakeholders who responded to the question (source: Regen)

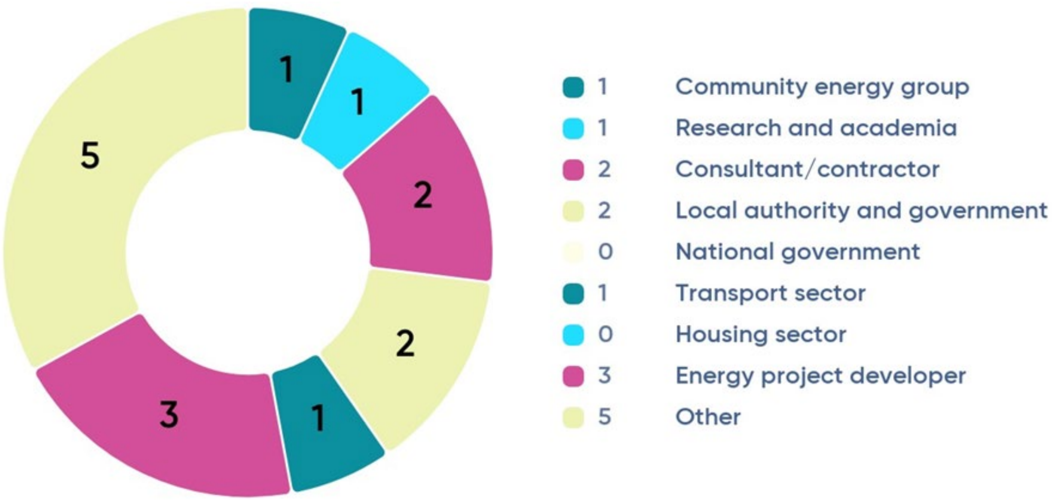

Figure 10 Extract from the North of Scotland regional webinar showing the industry sector of stakeholders who responded to the question (source: Regen)

3.3. Scottish Government workshop

A discussion-led workshop was held with key representatives from Scottish Government to validate and improve the DFES assumptions and ensure that the forecasts for the North of Scotland accurately reflect relevant Scottish energy policies and net zero ambitions. The primary objectives of the workshop were to clarify the latest Scottish Government policy and regulation for key technologies that should be considered in the DFES analysis and to capture Scottish Government views on industry- and technology-specific trends in Scotland.

Equivalent DFES workshops with Scottish Government were held successfully in 2020 and 2021 to inform DFES modelling. These workshops signposted in-draft policy statements for specific technology sectors and clarified some Scottish energy policy nuances (for example, types of housing that Scottish Government is targeting in phases through heat pump support policy). This engagement work also led to the direct reflection of Scottish Government policy under the Consumer Transformation scenario in prior iterations of SSEN's DFES. For DFES 2024, we have continued this aspect of the methodology, reflecting key Scottish policies under the **Electric Engagement** and **Holistic Transition** scenarios.

Ten Scottish Government stakeholders, representing a broad range of policy and technology expertise, engaged in the session. The feedback from these stakeholders was a key input that helped corroborate and develop the DFES modelling assumptions for the specific technology growth and spatial modelling factors for the North of Scotland licence area.

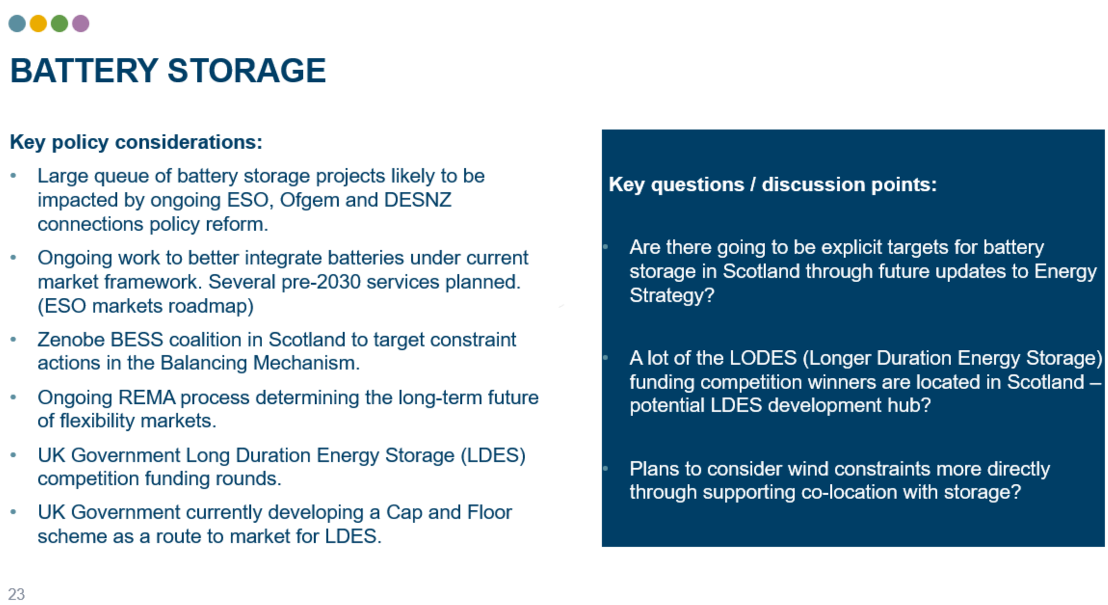

Figure 11 Extract from the Scottish Government workshop showing the key policy considerations and discussion points for battery storage

3.4. Local authority engagement

Proactive engagement with local authorities across SSEN's licence areas has been a crucial part of the DFES process for many years, especially as more local authorities move from planning to actionable programmes of work. Integrating local policies and targets into the DFES ensures that the spatial distribution reflects local plans. Direct engagement with local authorities for DFES 2024 included three workstreams: a new property developments data exchange, a local energy strategy survey and a review process for LAEP and LHEES targets.

3.4.1. New property developments data exchange

Regen hosted an online data exchange for each local authority in SSEN's two licence areas to collect up-to-date information on the location, building type and buildout rates of new housing and new non-domestic development floorspace. For each local authority, specific information was sought for:

- The best view of new housing developments, limited to strategic housing developments of 100 houses or more
- The best view of new non-domestic development floorspace, categorised by eight commercial and industrial development archetypes (office, retail, factory and warehouse, hospital, hotel, medical, restaurant, school and college, university, sport and leisure, and other).

New property developments are one of the building blocks of the DFES analysis and the updated registers directly inform the new developments projections in the relevant local authority and specific ESA substation areas.

3.4.2. Local energy strategy survey

Local authorities were invited to respond to a local energy strategy survey which asked questions about in-place, in-progress or future plans for sector decarbonisation strategies in their geographic area. This included questions about low-carbon transport zoning, low-carbon heat targets, renewable energy targets/zoning, waste collection policy, hydrogen development and LAEPs. The responses to these questions were used to validate, inform and evidence the spatial distribution factors and local ambition weightings that govern the regional uptake of individual technologies. For example, the presence of a specific heat pump strategy and/or target was used to increase the weighting applied to an ESA's 'local ambition' spatial factor for heat pump adoption in the given local authority area.

A summary of the responses to the local energy strategy survey received from each of the local authorities in SSEN's two licence areas is shown in Figures 12 – 15.

Legend
Yes
In development
No
No response

Local authority	Transport			Heat		DFES
	Plans to reduce transport emissions	Public EV charger plans	EV charging in new developments	Heat decarbonisation plans	Heat networks plans	DFES used in planning
Aberdeen City	In development	Yes	Yes	Yes	In development	-
Aberdeenshire	Yes	Yes	Yes	Yes	In development	No
Angus	-	-	-	In development	In development	-
Argyll and Bute	-	Yes	Yes	Yes	Yes	In development
Arun	No	Yes	Yes	Yes	No	-
Basingstoke and Deane	Yes	Yes	Yes	Yes	No	No
BCP (Bournemouth, Christchurch, Poole)	In development	In development	In development	In development	Yes	Yes
Bracknell Forest	Yes	Yes	Yes	In development	No	No
Brent	-	-	-	-	-	-
Buckinghamshire	Yes	Yes	Yes	No	No	Yes
Cherwell	Yes	Yes	In development	Yes	Yes	No
Chichester	-	-	-	-	-	-
Cotswold	Yes	Yes	In development	Yes	Yes	No
Dorset	Yes	Yes	Yes	In development	In development	No
Dundee City	Yes	Yes	Yes	Yes	Yes	In development
Ealing	-	-	Yes	-	Yes	-
East Hampshire	Yes	Yes	Yes	In development	No	No
Eastleigh	-	Yes	-	No	-	-
Fareham	In development	Yes	No	No	No	No
Gosport	Yes	In development	Yes	No	No	No
Guildford	Yes	Yes	Yes	No	No	No
Hammersmith and Fulham	-	-	-	-	-	-
Harrow	-	-	-	-	-	-
Hart	Yes	Yes	Yes	Yes	No	No
Havant	Yes	Yes	Yes	Yes	In development	No
Highland	-	-	-	-	-	-
Hillingdon	Yes	Yes	Yes	Yes	No	No
Horsham	Yes	In development	Yes	Yes	No	No
Hounslow	Yes	Yes	In development	Yes	Yes	Yes
Isle of Wight	Yes	Yes	Yes	In development	In development	No
Mendip	In development	-	-	In development	-	-

Figure 12 Summary of the 2024 local energy strategy survey responses (part 1)

Yes
In development
No
No response

Local authority	Transport			Heat		DFES
	Plans to reduce transport emissions	Public EV charger plans	EV charging in new developments	Heat decarbonisation plans	Heat networks plans	DFES used in planning
Moray	Yes	Yes	Yes	In development	In development	No
Na h-Eileanan Siar	Yes	In development	Yes	Yes	No	-
New Forest	Yes	Yes	Yes	No	No	No
North Ayrshire	-	-	-	-	-	-
Old Oak and Park Royal	Yes	Yes	Yes	Yes	-	No
Orkney Islands	Yes	Yes	-	-	-	-
Oxford	Yes	Yes	Yes	Yes	Yes	No
Perth and Kinross	In development	Yes	In development	In development	In development	-
Portsmouth	Yes	Yes	No	In development	No	In development
Reading	Yes	Yes	Yes	Yes	Yes	-
Richmond upon Thames	Yes	Yes	Yes	Yes	Yes	No
Runnymede	Yes	Yes	Yes	Yes	No	In development
Rushmoor	No	In development	No	No	No	No
Shetland Islands	Yes	Yes	No	In development	No	-
Slough	Yes	Yes	Yes	Yes	Yes	No
Somerset	Yes	Yes	Yes	In development	In development	Yes
South Oxfordshire	Yes	Yes	Yes	-	No	No
Southampton	Yes	Yes	In development	No	Yes	-
Spelthorne	-	-	-	-	-	-
Stirling	Yes	Yes	-	Yes	Yes	No
Surrey Heath	No	Yes	In development	No	Yes	No
Swindon	-	-	-	-	-	-
Test Valley	Yes	In development	No	In development	In development	No
Vale of White Horse	Yes	Yes	Yes	-	No	No
Waverley	Yes	Yes	Yes	No	No	No
West Berkshire	Yes	Yes	-	Yes	Yes	-
West Dunbartonshire	-	-	-	-	-	-
West Oxfordshire	Yes	Yes	In development	In development	In development	-
Wiltshire	Yes	In development	In development	In development	No	In development
Winchester	Yes	Yes	Yes	Yes	No	No
Windsor and Maidenhead	Yes	Yes	Yes	Yes	-	-
Wokingham	Yes	Yes	Yes	No	No	-

Figure 13 Summary of the 2024 local energy strategy survey responses (part 2)

Yes	
In development	
No	
No response	

Local authority	Renewables			Waste	Hydrogen	Plans and ambitions	
	Renewables strategy	Renewables targets	Allocated areas for renewables	Waste collection plans	Hydrogen strategy	Emissions plans	Local Area Energy Plan
Aberdeen City	Yes	-	Yes	Yes	Yes	Yes	In development
Aberdeenshire	Yes	No	In development	Yes	-	Yes	Yes
Angus	-	-	-	-	-	-	-
Argyll and Bute	Yes	No	Yes	-	Yes	Yes	Yes
Arun	In development	No	No	In development	No	No	No
Basingstoke and Deane	In development	No	In development	Yes	No	Yes	No
BCP (Bournemouth, Christchurch, Poole)	In development	In development	In development	Yes	No	Yes	In development
Bracknell Forest	In development	No	No	In development	No	Yes	No
Brent	-	-	-	-	-	-	-
Buckinghamshire	No	No	No	Yes	No	Yes	No
Cherwell	-	No	No	Yes	No	Yes	No
Chichester	-	-	-	-	-	-	-
Cotswold	Yes	In development	In development	Yes	Yes	Yes	In development
Dorset	In development	No	In development	Yes	Yes	Yes	In development
Dundee City	Yes	No	Yes	Yes	Yes	Yes	Yes
Ealing	-	-	No	-	-	-	Yes
East Hampshire	Yes	No	No	In development	No	Yes	No
Eastleigh	No	No	-	-	No	-	-
Fareham	No	No	No	No	No	No	No
Gosport	No	No	No	No	No	Yes	No
Guildford	No	No	No	Yes	No	Yes	No
Hammersmith and Fulham	-	-	-	-	-	-	-
Harrow	-	-	-	-	-	-	-
Hart	Yes	No	Yes	Yes	No	No	No
Havant	Yes	No	No	Yes	No	Yes	No
Highland	-	-	-	-	-	-	-
Hillingdon	No	Yes	No	Yes	No	Yes	Yes
Horsham	In development	No	No	Yes	In development	Yes	In development
Hounslow	No	Yes	Yes	Yes	No	Yes	Yes
Isle of Wight	Yes	No	No	Yes	No	In development	In development
Mendip	Yes	Yes	-	-	No	Yes	No

Figure 14 Summary of the 2024 local energy strategy survey responses (part 3)

Yes
In development
No
No response

Local authority	Renewables			Waste	Hydrogen	Plans and ambitions	
	Renewables strategy	Renewables targets	Allocated areas for renewables	Waste collection plans	Hydrogen strategy	Emissions plans	Local Area Energy Plan
Moray	Yes	No	Yes	Yes	Yes	Yes	No
Na h-Eileanan Siar	Yes	Yes	Yes	-	Yes	-	-
New Forest	No	No	No	Yes	No	In development	No
North Ayrshire	-	-	-	-	-	-	-
Old Oak and Park Royal	Yes	Yes	In development	No	-	Yes	-
Orkney Islands	-	-	-	-	-	Yes	Yes
Oxford	Yes	In development	In development	Yes	No	Yes	In development
Perth and Kinross	Yes	Yes	In development	Yes	In development	Yes	Yes
Portsmouth	No	No	No	Yes	No	Yes	In development
Reading	No	-	-	Yes	-	Yes	-
Richmond upon Thames	Yes	No	No	Yes	Yes	Yes	No
Runnymede	Yes	No	No	Yes	No	Yes	No
Rushmoor	No	No	No	Yes	No	Yes	No
Shetland Islands	In development	No	No	Yes	In development	Yes	No
Slough	No	Yes	No	No	No	Yes	No
Somerset	Yes	Yes	In development	Yes	No	Yes	In development
South Oxfordshire	-	In development	In development	Yes	No	Yes	In development
Southampton	No	In development	No	No	Yes	Yes	In development
Spelthorne	-	-	-	-	-	-	-
Stirling	Yes	No	Yes	-	No	Yes	Yes
Surrey Heath	No	No	No	No	No	Yes	No
Swindon	-	-	-	-	-	-	-
Test Valley	No	No	No	In development	No	In development	No
Vale of White Horse	-	In development	In development	Yes	No	Yes	In development
Waverley	No	No	No	Yes	No	Yes	No
West Berkshire	No	No	No	-	No	Yes	Yes
West Dunbartonshire	-	-	-	-	-	-	-
West Oxfordshire	In development	In development	No	In development	No	Yes	In development
Wiltshire	No	-	No	No	No	Yes	In development
Winchester	-	Yes	No	Yes	No	No	No
Windsor and Maidenhead	-	-	-	-	-	-	-
Wokingham	Yes	Yes	Yes	Yes	No	Yes	No

Figure 15 Summary of the 2024 local energy strategy survey responses (part 4)

3.4.3. LAEP and LHEES technology targets

The development of local energy sector plans, both LAEPs and, in Scotland, LHEES, are important sources of evidence that determine local energy planning and inform local network planning.

- LAEPs are developed by local authorities and set out the required targets and steps to achieving net zero in local areas, in line with local ambition and sector-specific strategy
- The Scottish LHEES detail each local authority's approach to specifically decarbonising local heating systems and improving the energy efficiency of the local housing stock.

As the proposed RESPs are further defined and implemented by NESO, LAEP and LHEES documents published by local authorities will play an increasingly significant role. As a bottom-up, evidence-led and locally driven analysis of future electricity distribution network load growth, the DFES has reviewed, reconciled and integrated published LAEP and LHEES targets, where viable, into the 2024 analysis for the first time.

LAEP and LHEES review methodology

For DFES 2024, the published LAEPs and LHEES were reviewed to identify quantitative technology targets. For these targets to be successfully reconciled and integrated into the DFES analysis, three criteria were essential:

- **Clearly specified technology and associated units:** for the target to be considered, it must be clearly related to a specified technology or range of technologies (for example, rooftop solar, heat pumps, EV chargers, etc) in a unit that is compatible with DFES analysis (for example, MW capacity, number of heat pumps, number of EV cars, etc). Generic targets that were stated in terms of total energy generation (for example, in units of GWh) would have required multiple assumptions to be made for load factors and related connected capacities which would subsequently have introduced inaccuracies when reconciling to the DFES analysis and could, therefore, not be included.
- **Quantified target:** for the target to be considered, it must also be clearly quantified (for example, 50 MW or 100,000 EVs, etc). Targets that were qualitatively defined (for example, targets stating that a technology would 'meet all local energy demand') could not be reconciled or compared to the DFES projections.
- **Time-bound target:** for the target to be considered, it must have a specified target date or year for it to be accurately compared to the DFES scenario projections.

In addition to technology adoption targets, other data points from the LAEP and LHEES documents were also considered:

- Any clearly identified zoning and/or geographic areas earmarked for particular technologies (for example, low emissions vehicle zones or renewable energy development zones)
- Any mentions of specific projects were also recorded and cross-checked with the SSEN connections data to ensure alignment.

An important consideration is that the DFES only represents distribution network connections and, in some cases, LAEPs and/or LHEES may bundle distribution- and transmission-connected projects or overarching energy system targets together. Where the connection tier was unknown or clarification was unavailable, the DFES has made an informed assumption on the proportion of the technology target that is likely to connect at the distribution network level.

LAEP and LHEES DFES reconciliation and integration methodology

The identified targets were then compared and reconciled to the draft DFES projections for the equivalent future generation, storage or demand technologies. There were four potential outcomes when each technology target was compared to its DFES equivalent:

1. **Target within the DFES projection envelope:** if the stated LAEP or LHEES technology targets were within the envelope of equivalent outcomes for the four DFES scenarios, then no adjustments to the DFES projections would be required as the target is already reflected.
2. **Target below the DFES projection envelope:** if the stated LAEP or LHEES technology targets were below the least ambitious DFES scenario, then no adjustments to the DFES projections would be required as the DFES envelope allows for a credible, but more ambitious, position to inform network planning.
3. **Target slightly above or aligned to the DFES projection envelope:** if the stated LAEP or LHEES technology targets were credibly above, or aligned to, the DFES envelope, then the most ambitious DFES scenario would be uplifted proportionally for the ESAs within that local authority area, to ensure the local authority target level of ambition is reflected.
4. **Target significantly above the DFES projection envelope:** if the stated LAEP or LHEES targets were significantly above the DFES scenario framework (for example, substantially above the DFES envelope, to the extent that reflecting the targets directly would deviate significantly from the DFES and/or national level FES scenarios), then the most ambitious DFES scenario would be moderately uplifted to reflect an increased local authority ambition for that technology. However, this uplift increase would not be to the extent proposed in the target. In these cases, the DFES analysis has reflected an uplift of 10% above the most ambitious scenario within the near term (to 2030), scaling up to 30% above the most ambitious scenario by 2050. This reflects the inherent uncertainty in long-term projections compared to near-term projections.

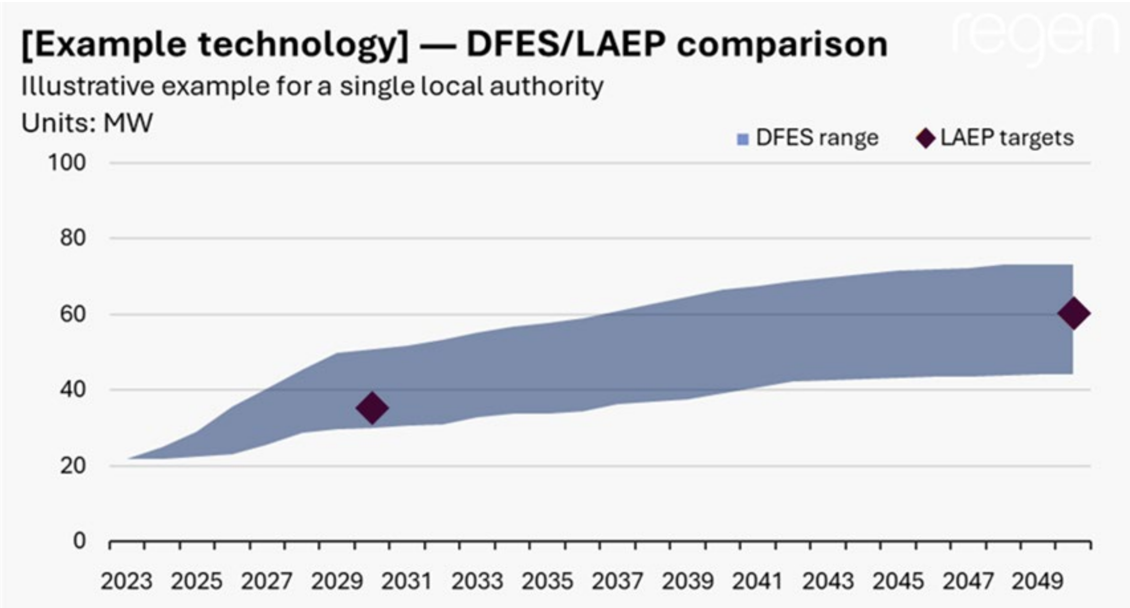

Figure 16 Illustrative example of a LAEP and/or LHEES target that is within or below the DFES projection envelope (source: Regen)

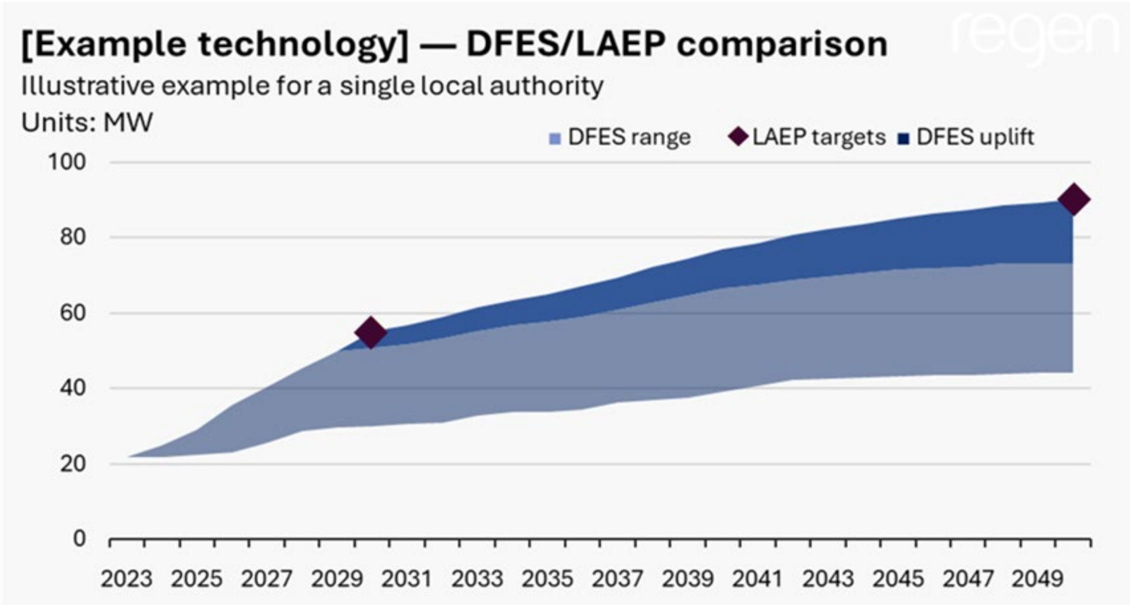

Figure 17 Illustrative example of a LAEP and/or LHEES target that is credibly above or aligned to the DFES projection envelope (source: Regen)

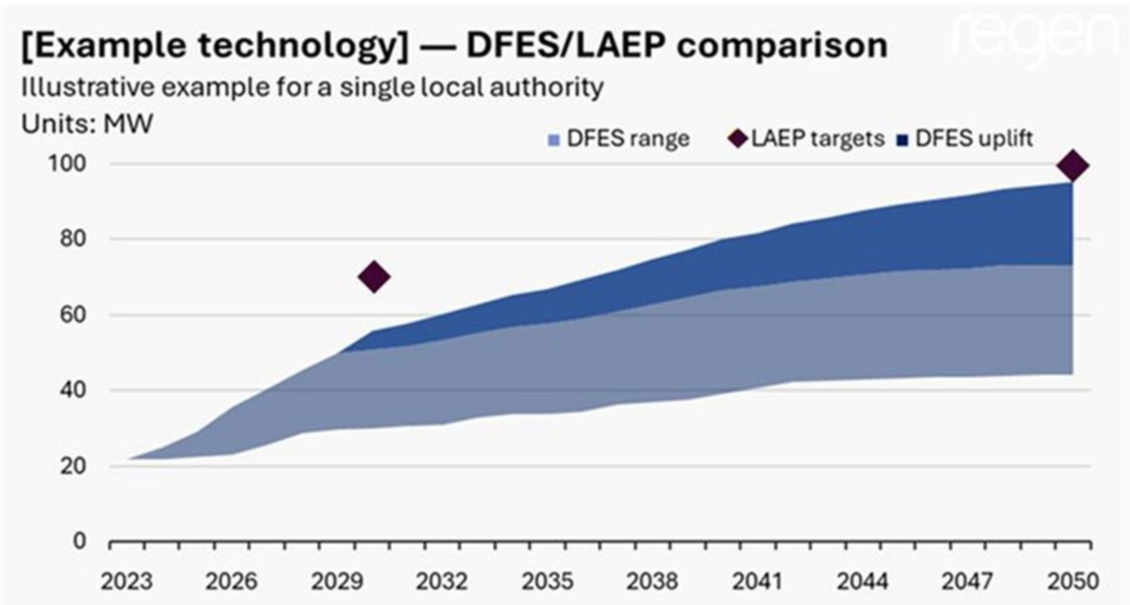

Figure 18 Illustrative example of a LAEP and/or LHEES target that is significantly above the DFES projection envelope (source: Regen)

Where clearly identified zoning and/or geographic areas earmarked for a specific technology were specified, these were incorporated into the spatial resource assessment for that technology and used to influence the geographic distribution factors.

Where data on specific projects that are either under development or soon to be under development were detailed in the LAEP and/or LHEES (for example, rooftop solar on council-owned buildings or public EV charging stations) this was also recorded. This data was directly integrated into the existing project pipeline data (primarily based on a register of SSEN's accepted connection offers), assessed and used to inform the near-term DFES projections.

Published LAEP and LHEES documents

At the time of the DFES analysis commencing in August 2024, there were two published LAEPs and one finalised, but not published, LAEP across the North of Scotland and Southern England licence areas.

- In Scotland, the Perth and Kinross local authority published their LAEP in January 2024.
- Seven local authorities developed a joint LAEP under the West London Energy Planning Partnership, published in July 2023. These local authorities are Brent, Ealing, Harrow, Hammersmith and Fulham, Hillingdon, Hounslow and Richmond upon Thames.
- The Old Oak Park Development Corporation (OPDC) finalised its LAEP in February 2024, but it was not yet published at the time of writing. The OPDC was established to regenerate the 640-hectare Old Oak Opportunity Area spanning the three London boroughs of Brent, Ealing, and Hammersmith and Fulham. Although the OPDC is not a local authority, the scale of the redevelopment site is significant enough to influence the local DFES projections for the area and it was, therefore, important to include it in the analysis.

Figure 19 The Perth and Kinross LAEP (source: Perth and Kinross Climate Action)

In addition, at the time of the DFES analysis commencing in August 2024, there were four local authorities in the North of Scotland with published LHEES documents and one local authority with a published Regional Energy Masterplan (which, for the purposes of DFES, has been categorised as an LHEES document).

- Dundee City Council published its LHEES in April 2024
- Moray Council published its LHEES in August 2024
- Na h-Eileanan Siar's LHEES was approved in November 2023
- West Dunbartonshire Council published its LHEES in late 2024
- Stirling Council and Clackmannanshire Council have developed a joint Regional Energy Masterplan.

Figure 20 The West Dunbartonshire LHEES (source: West Dunbartonshire Council)

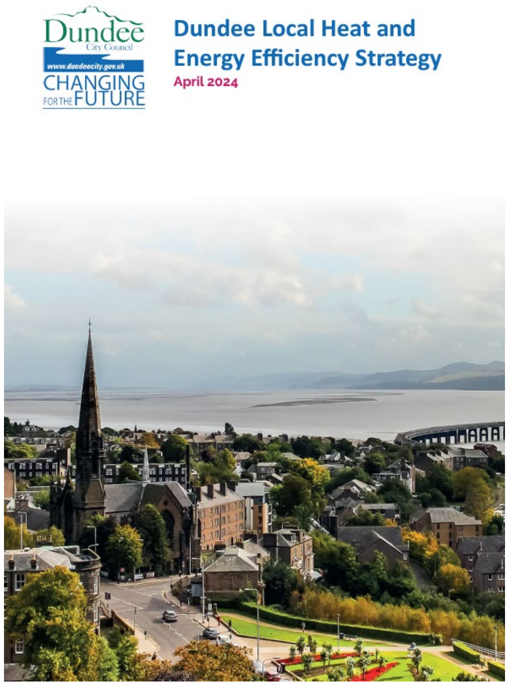

Figure 21 The Dundee City LHEES (source: Dundee City Council)

LAEP and LHEES targets and resulting actions for DFES 2024

Using the methodology described above, all available LAEPs and LHEES were reviewed, with 47 targets recorded:

- 28 targets met all the criteria for reconciliation to the DFES data, having a clearly specified technology and associated units, a quantified target and a stated timeframe
- 19 targets did not meet the criteria due to missing data, unit incompatibility, timeframe or core scenario differences
- Unfortunately, no targets were identified from the Moray Council or the Na h-Eileanan Siar LHEES publications.

Table 6 details the 28 targets that were able to reconciled to the DFES dataset and the resulting actions, whilst Table 7 highlights the 19 targets that were not able to be reconciled to the DFES data and the reasons for this.

Table 6 LAEP and LHEES targets that **have been** reconciled to the DFES and the resulting adjustments

	Local authority	Borough	Technology	Sub-technology	Target	Units	Timeframe
1	Perth and Kinross	n/a	Onshore wind	n/a	14	MW	2035
	This target is within the DFES projection envelope and no adjustments to the DFES data were required.						
2	Perth and Kinross	n/a	Hydropower	n/a	6	MW	2035
	This target is within the DFES projection envelope and no adjustments to the DFES data were required.						
3	Perth and Kinross	n/a	Electric vehicles	n/a	5x baseline level	number	2029
	A fivefold increase in the number of EVs equates to 13,390 EVs registered in 2029 in the local authority area. This target is within the DFES projection envelope and no adjustments to the DFES data were required.						
4	Perth and Kinross	n/a	Heat pumps	Domestic	2x baseline level	number	2033
	A doubling of the current baseline equates to 5,778 domestic heat pumps installed by 2033 in the local authority area. This target is within the DFES projection envelope and no adjustments to the DFES data were required.						
5	Perth and Kinross	n/a	Heat pumps	Non-domestic	50% of non-domestic heat pump capacity installed		2041
	Installations of non-domestic heat pumps in 2041 are already projected to exceed 50% of the total uptake in both 2045 and 2050 in all four scenarios. This target is within the DFES projection envelope and no adjustments to the DFES data were required.						
6	Perth and Kinross	n/a	Heat pumps	Domestic and non-domestic	47,700	number	2045
	This target is within the DFES projection envelope and no adjustments to the DFES data were required.						
7	Perth and Kinross	n/a	Heat networks	n/a	3,000	number of properties	2045
	Although heat networks are not in scope for DFES 2024, the underlying DFES heat model assumes more than 3,000 properties in Perth and Kinross will be connected to heat networks in the most ambitious net zero scenarios. As a result, this target is within the DFES projection envelope and no adjustments to the DFES data were required.						
8	Perth and Kinross	n/a	Solar PV	Rooftop (<10 kW & 10 kW - 1 MW)	390,000	panels	2045
	This target is within the DFES projection envelope and no adjustments to the DFES data were required.						

9	Perth and Kinross	n/a	Battery storage	n/a	13,500	number	2045
	This target is above the maximum DFES envelope, and the most ambitious DFES scenario (for battery storage this is **Holistic Transition**) has been uplifted by 10% to reflect this ambition for the Perth and Kinross local authority area.						
10	Perth and Kinross	n/a	EV chargers	n/a	10,500	number	2045
	This target is above the maximum DFES envelope, and the most ambitious DFES scenario (for EV chargers this is **Electric Engagement**) has been uplifted by 10% to reflect this ambition for the Perth and Kinross local authority.						
11	West London	n/a	Solar PV	Small-scale	1,200	MW	2030
	This target is above the maximum DFES envelope, and the most ambitious DFES scenario (for small-scale solar PV this is **Holistic Transition**) has been uplifted by 10% to reflect this ambition for the West London geographic area.						
12	West London	n/a	EV chargers	Non-domestic	47,000	number	2050
	This target is above the maximum DFES envelope, and the most ambitious DFES scenario (for non-domestic EV chargers this is **Electric Engagement**) has been uplifted by 10% to reflect this ambition for the West London geographic area.						
13	West London	Brent	EV chargers	Non-domestic	3,754	number	2030
	This target is above the maximum DFES envelope, and the most ambitious DFES scenario (for non-domestic EV chargers this is **Electric Engagement**) has been uplifted by 10% to reflect this ambition for the Brent local authority.						
14	West London	Brent	EV chargers	Non-domestic	5,792	number	2050
	This target is above the maximum DFES envelope, and the most ambitious DFES scenario (for non-domestic EV chargers this is **Electric Engagement**) has been uplifted by 10% to reflect this ambition for the Brent local authority.						
15	West London	Ealing	EV chargers	Non-domestic	2,000	number	2026
	This target is above the maximum DFES envelope, and the most ambitious DFES scenario (for non-domestic EV chargers this is **Electric Engagement**) has been uplifted by 10% to reflect this ambition for the Ealing local authority.						
16	West London	Ealing	EV chargers	Non-domestic	3,971	number	2030
	This target is above the maximum DFES envelope, and the most ambitious DFES scenario (for non-domestic EV chargers this is **Electric Engagement**) has been uplifted by 10% to reflect this ambition for the Ealing local authority.						
17	West London	Ealing	EV chargers	Non-domestic	6,121	number	2050
	This target is above the maximum DFES envelope, and the most ambitious DFES scenario (for non-domestic EV chargers this is **Electric Engagement**) has been uplifted by 10% to reflect this ambition for the Ealing local authority.						
18	West London	Harrow	EV chargers	Non-domestic	4,156	number	2030
	This target is above the maximum DFES envelope, and the most ambitious DFES scenario (for non-domestic EV chargers this is **Electric Engagement**) has been uplifted by 10% to reflect this ambition for the Harrow local authority.						

29	West London	Harrow	EV chargers	Non-domestic	6,117	number	2050
	This target is above the maximum DFES envelope, and the most ambitious DFES scenario (for non-domestic EV chargers this is **Electric Engagement**) has been uplifted by 10% to reflect this ambition for the Harrow local authority.						
20	West London	Hillingdon	EV chargers	Non-domestic	7,335	number	2030
	This target is above the maximum DFES envelope, and the most ambitious DFES scenario (for non-domestic EV chargers this is **Electric Engagement**) has been uplifted by 10% to reflect this ambition for the Hillingdon local authority.						
21	West London	Hillingdon	EV chargers	Non-domestic	10,741	number	2050
	This target is above the maximum DFES envelope, and the most ambitious DFES scenario (for non-domestic EV chargers this is **Electric Engagement**) has been uplifted by 10% to reflect this ambition for the Hillingdon local authority.						
22	West London	Hounslow	EV chargers	Non-domestic	3,955	number	2030
	This target is above the maximum DFES envelope, and the most ambitious DFES scenario (for non-domestic EV chargers this is **Electric Engagement**) has been uplifted by 10% to reflect this ambition for the Hounslow local authority.						
23	West London	Hounslow	EV chargers	Non-domestic	6,076	number	2050
	This target is above the maximum DFES envelope, and the most ambitious DFES scenario (for non-domestic EV chargers this is **Electric Engagement**) has been uplifted by 10% to reflect this ambition for the Hounslow local authority.						
24	West London	Richmond-upon-Thames	EV chargers	Non-domestic	2,643	number	2030
	This target is above the maximum DFES envelope, and the most ambitious DFES scenario (for non-domestic EV chargers this is **Electric Engagement**) has been uplifted by 10% to reflect this ambition for the Richmond-upon-Thames local authority.						
25	West London	Richmond-upon-Thames	EV chargers	Non-domestic	3,951	number	2050
	This target is above the maximum DFES envelope, and the most ambitious DFES scenario (for non-domestic EV chargers this is **Electric Engagement**) has been uplifted by 10% to reflect this ambition for the Richmond-upon-Thames local authority.						
26	Dundee City	n/a	Electric vehicles	n/a	20%	Total vehicle registrations	2026
	This target is within the DFES projection envelope and no adjustments to the DFES data were required.						
27	OPDC	n/a	New developments	Data centres	120	MVA	2025
	The OPDC LAEP specifies that two or three new data centres should be built from 2025. This target is within the DFES projection envelope and no adjustments to the DFES data were required.						
28	OPDC	n/a	Solar PV	n/a	100	MW	2050
	This target is within the DFES projection envelope and no adjustments to the DFES data were required.						

Table 7 LAEP and LHEES targets that **have not been** reconciled to the DFES

	Local authority	Borough	Technology	Sub-technology	Target	Units	Timeframe
1	Perth and Kinross	n/a	Solar PV	Rooftop (<10 kW & 10 kW - 1 MW)	2x baseline level	MW	2025
	A doubling of the current baseline equates to 37.4 MW, which is 20% higher than the maximum DFES projection in 2025. However, no adjustments to the DFES data have been made as the DFES analysis already assumes all the projects in the pipeline will connect and there is no evidence of further projects looking to connect in 2025 to account for this additional uplift.						
2	Perth and Kinross	n/a	Hydropower	n/a	117	sites	2045
	This target cannot be reconciled to the DFES analysis because of the unit incompatibility and the risk of inaccurately assuming the capacity of each of the 117 sites specified.						
3	Perth and Kinross	n/a	Onshore wind	n/a	14	Turbines	2045
	This target cannot be reconciled to the DFES analysis because of the unit incompatibility and the risk of inaccurately assuming the capacity of each of the 14 turbines specified.						
4	West London	n/a	Heat pumps	n/a	50,000	Number of install-ations per year	2023 – 2030
	This target cannot be reconciled to the DFES analysis as a 2030 net zero target is outside of the DFES scenario framework, where 2050 is the target timeframe for the three net zero scenarios.						
5	Dundee City	n/a	Heat networks	n/a	554	GWh/year	Timeframe not specified
	This target cannot be reconciled to the DFES analysis because heat networks are out of scope for DFES 2024, the units cannot confidently be reconciled and there is no timeframe specified for comparison.						
6	Stirling and Clackmannanshire	Stirling	District heat	n/a	20,800	MWh/year	Timeframe not specified
	The Stirling and Clackmannanshire LHEES contains two targets for district heat networks in Stirling. The first target is for 20,800 MWh/year to be supplied by projects that are in planning during 2024 – 25. However, this target cannot be reconciled to the DFES analysis due to the unit incompatibility and the absence of a specified timeframe for the construction or operation of the district heat network.						
7	Stirling and Clackmannanshire	Stirling	District heat	n/a	13,700	MWh/year	Timeframe not specified
	The Stirling and Clackmannanshire LHEES contains two targets for district heat networks in Stirling. The second target is for 13,700 MWh/year supplied by projects that are in planning during 2028 – 29, 2029 – 30 and 2030 – 31. Again, this target cannot be reconciled to the DFES analysis due to the unit incompatibility and the absence of a specified timeframe for the construction or operation of the district heat network.						
8	Stirling and Clackmannanshire	Stirling	Solar PV	n/a	5,846	MWh/year	Timeframe not specified

	The Stirling and Clackmannanshire LHEES contains three targets for solar PV in Stirling. The first target is for 5,846 MWh/year supplied by projects that are in planning during 2023 – 24. This target cannot be reconciled to the DFES analysis due to the unit incompatibility and the absence of a specified timeframe for the construction or operation of the solar PV projects.						
9	Stirling and Clackmannanshire	Stirling	Solar PV	n/a	14,980	MWh/year	Timeframe not specified
	The Stirling and Clackmannanshire LHEES contains three targets for solar PV in Stirling. The second target is for 14,980 MWh/year supplied by projects that are in planning during 2028 – 29 and it is noted that this target may include some other renewable technologies. This target cannot be reconciled to the DFES analysis due to the unit incompatibility and the absence of a specified timeframe for the construction or operation of the solar PV projects.						
10	Stirling and Clackmannanshire	Stirling	Solar PV	n/a	2,390	MWh/year	Timeframe not specified
	The Stirling and Clackmannanshire LHEES contains three targets for solar PV in Stirling. The third target is for 2,390 MWh/year supplied by projects that are in planning during 2033 – 34. Again, unfortunately, this target cannot be reconciled to the DFES analysis due to the unit incompatibility and the absence of a specified timeframe for the construction or operation of the solar PV projects.						
11	Stirling and Clackmannanshire	Clackmannanshire	District heat	n/a	22,000	MWh/year	Timeframe not specified
	The Stirling and Clackmannanshire LHEES contains two targets for district heat networks in Clackmannanshire. The first target is for 22,000 MWh/year to be supplied by projects that are in planning during 2023 – 24 and 2024 – 25. This target cannot be reconciled to the DFES analysis due to the unit incompatibility and the absence of a specified timeframe for the construction or operation of the district heat network.						
12	Stirling and Clackmannanshire	Clackmannanshire	District heat	n/a	4,600	MWh/year	Timeframe not specified
	The Stirling and Clackmannanshire LHEES contains two targets for district heat networks in Clackmannanshire. The second target is for 4,600 MWh/year to be supplied by projects that are in planning during 2028 – 29. Again, unfortunately, this target cannot be reconciled to the DFES analysis due to the unit incompatibility and the absence of a specified timeframe for the construction or operation of the district heat network.						
13	Stirling and Clackmannanshire	Clackmannanshire	Solar PV	n/a	3,040	MWh/year	Timeframe not specified
	The Stirling and Clackmannanshire LHEES contains three targets for solar PV in Clackmannanshire. The first target is for 3,040 MWh/year supplied by projects that are in planning during 2023 – 24. This target cannot be reconciled to the DFES analysis due to the unit incompatibility and the absence of a specified timeframe for the construction or operation of the solar PV projects.						
14	Stirling and Clackmannanshire	Clackmannanshire	Solar PV	n/a	6,410	MWh/year	Timeframe not specified
	The Stirling and Clackmannanshire LHEES contains three targets for solar PV in Clackmannanshire. The second target is for 6,410 MWh/year supplied by projects that are in planning during 2028 – 29 and 2030 – 31. This target cannot be reconciled to the DFES analysis due to the unit incompatibility and the absence of a specified timeframe for the construction or operation of the solar PV projects.						
15	Stirling and Clackmannanshire	Clackmannanshire	Solar PV	n/a	3,600	MWh/year	Timeframe not specified

	The Stirling and Clackmannanshire LHEES contains three targets for solar PV in Clackmannanshire. The third target is for 3,600 MWh/year supplied by projects that are in planning during 2033 – 35. Again, unfortunately, this target cannot be reconciled to the DFES analysis due to the unit incompatibility and the absence of a specified timeframe for the construction or operation of the solar PV projects.						
16	OPDC	n/a	Electrification of buildings and transport		170	MVA	Timeframe not specified
	Unfortunately, this target cannot be reconciled to the DFES analysis because of the unit and technology incompatibility and the unclear timeframe.						
17	OPDC	n/a	District heat	n/a	95	GWh/year	Timeframe not specified
	The OPDC LAEP notes that both the OPDC and the Greater London Authority are developing a strategic heat network which is due to supply up to 95 GWh of heat across five phases of installation. Unfortunately, this target cannot be reconciled to the DFES analysis due to the unit incompatibility and the absence of a specified timeframe for the construction or operation of each of the phases of the district heat network.						
18	West Dunbartonshire	n/a	Heat networks	n/a	67.5	GWh/year	2030
	Unfortunately, this target cannot be reconciled to the DFES analysis because of the unit incompatibility.						
19	West Dunbartonshire	n/a	Heat networks	n/a	162.6	GWh/year	Timeframe not specified
	Unfortunately, this target cannot be reconciled to the DFES analysis because of the unit incompatibility and the absence of a clear timeframe for the target.						

3.5. Targeted sector and developer engagement

Direct engagement with the wider energy sector and large-scale project developers plays a key role in the DFES analysis. The DFES team have also continued to engage with the NESO FES team, as part of the launch of FES 2024 and throughout the ongoing analysis, to discuss and share modelling assumptions and market intelligence.

3.5.1. Sector and developer engagement

There are a significant number of energy generation and storage projects with accepted connection offers in SSEN's licence areas. These projects form the pipeline for each technology and are individually researched to determine key factors (for example, planning status) that influence the near-term technology projections. To supplement this research, the Regen project team also engaged directly with individual energy project developers and sector representatives to better understand their plans and ambitions. This engagement included:

- Discussions with a select group of project developers holding contracted connection offers with SSEN, to review the construction and commissioning timelines of key pipeline projects
- Discussions with other sector and technology representatives to augment and sense-check Regen's assumptions on near-term deployments and technology projections.

The feedback obtained from contracted project developers was used, alongside spatial planning status and Capacity Market activity evidence obtained through desktop research, to inform the scenario-specific growth projection logic for pipeline projects (for example, which project should be modelled to connect in which year, under which scenario).

The wider input obtained from engaging industry representatives and technology developers was used to inform the uptake and spatial factors for relevant technologies. For example, the results of the UK government's Electrolytic Allocation Rounds have been used to inform the location and scale of electrolysis projections in both licence areas.

Each of the technology summary chapters in the accompanying technical reports provides more information on stakeholder engagement. This includes details of the specific engagement undertaken for each technology, the feedback received and how it was used to influence and refine the DFES technology modelling.

3.5.2. Major energy user engagement

The decarbonisation plans and future energy usage estimations of major energy users in SSEN's licence areas can have a significant impact on the DFES projections in local areas. The DFES team engaged with the Energy Intensive User Group and Major Energy Users Council for input on industry plans regarding future electricity demand and onsite generation and storage. The feedback provided included:

- That SSEN is likely to see requests for supply capacity increases, driven mainly by onsite EV charging and the electrification of heating
- Some major energy users are currently using behind-the-meter Combined Heat and Power (CHP) plants which, when decommissioned, will require an increased import

capacity from SSEN, due to a reduction in self-supplied electricity generation and heat
- Some major energy user customers have plans to install significant amounts of onsite generation (mainly solar PV, but some other generation technologies too) to reduce grid electricity imports and energy costs and to meet decarbonisation targets.

This anecdotal evidence has predominantly been used to validate the adoption and spatial distribution of low-carbon technology and renewable energy generation.

Zero Carbon Oxford Partnership

For DFES 2024, Regen worked with Oxford City Council to gather insight from the members of the Zero Carbon Oxford Partnership (ZCOP), some of whom are major energy users with significant assets in SSEN's licence areas. This engagement provided insights into the potential changes in electricity demand and individual business plans for the decarbonisation of specific sites. Feedback received from the ZCOP included demand growth projections for industrial sites and data points that were used to validate and adjust the local spatial distribution factors for various technologies in the Oxford area (such as rooftop PV, EV charging, space heating, etc).

Section 4: Government policy and its influence on DFES

The UK government's commitment to 'make Britain a clean energy superpower by 2030' has already seen the launch of key policies, targets and regulatory reforms that will change various aspects of how we plan and invest in the UK energy system. Along with both regional and local government strategies, these are essential inputs into the DFES analysis and impact the technology projections on both a licence area level and a local level in the following ways:

- **National targets:** deployment targets in national policies are used as reference target figures for national deployment and uptake of specific technologies
- **National policy:** broader energy policies and mechanisms have been used to justify scenario-specific assumptions for some technologies
- **Local policy and targets:** local government strategies and targets have been used to influence the spatial distribution of technologies
- **Trade body recommendations and non-governmental plans:** for technologies where regulated government targets and ambitions were not available, policy recommendations on technology target setting from influential trade bodies have been reflected in net zero scenarios.

In the near term, the DFES projections are based on the current pipeline of projects which already inherently reflect the existing electricity market regulatory framework. Therefore, the immediate impacts of energy policy and the wider energy sector context are considered to be already represented in the detailed analysis of the known pipeline of projects. Over the medium and longer term, the envelope of the four scenarios within the DFES framework is designed to capture a range of credible futures for the UK energy market including ambitious changes to government policy, society, technology and the economy.

4.1. 2024 energy system headlines

There have been several key regulatory and policy announcements in 2024 that will impact the UK energy system and, therefore, the distribution network in SSEN's two licence areas.

4.1.1. NESO

NESO was launched as an independent and publicly owned body in October 2024. Previously part of National Grid group, NESO's core responsibility will be to oversee the strategic planning and design of the UK's energy networks and the acceleration to net zero.[3] Over the next few years, NESO will develop three key publications that will influence the future of the energy system:

- The SSEP will set out a blueprint and coordinated approach for the UK's energy system to help cut grid connection waiting times and provide cost-effective energy generation by mapping potential locations, quantities and types of electricity and storage infrastructure and hydrogen assets
- The aim of the CSNP is to recommend the infrastructure required for the transmission network to support a decarbonised energy grid by mapping the demand and optimal locations for offshore and onshore connections.
- NESO will also continue to produce the annual Future Energy Pathways report (also known as the FES framework) upon which the DFES analysis is based.

NESO will also support local-level energy planning by overseeing the development of RESPs. The ambition for the RESPs is to work with both the electricity and gas networks, local authorities and wider stakeholders to better enable strategic, whole-system planning of the energy system at a regional level to ensure the inclusion of local needs and ambitions. Due to the longer-term timeline for the creation and establishment of the regional bodies that will develop each of the RESPs, Ofgem and NESO are also looking to introduce a transitionary phase (known as 'tRESP') to provide support across 2025 and into 2026 to focus on:

- Structured collaboration and technical working groups on strategic network investment
- Consideration for local and regional growth plans
- The development of initial whole energy system regional scenarios
- Engagement with DNOs as they develop ED3 business plans.

4.1.2. Clean Power 2030

The UK government aims to make Britain a 'Clean Energy Superpower'.[4] This is the driving political force for Clean Power 2030 (CP30), defined as a future "where demand is met by clean sources, mainly renewables, with unabated gas-fired generation used only rarely to ensure security of supply, primarily during sustained periods of low wind."[5] To deliver this, UK government has created a 'Mission Control' function within the Department of Energy Security and Net Zero (DESNZ), which will focus on delivering the three building blocks required for CP30:

- Setting and tracking the overall approach to delivering 2030 across the energy system
- Real-time monitoring of progress on UK infrastructure projects critical to 2030
- Acting as an innovation centre by encouraging discussion among experts.

Published in December 2024, CP30 outlines the capacity requirements, split by generation technologies and locations, and the infrastructure required to enable clean power in the UK by 2030. NESO published an advisory report to the UK government in early November 2024 which discussed the premise of allocating specific technology capacity requirements and caps, both at the regional level and across transmission and distribution network tiers.[6] This NESO advice also reinforced the significant reforms being proposed to the grid connection application and queue management processes. Significant reforms will also be required for the spatial planning regimes in the UK to enable multiple energy projects (many very large scale and in strategic locations) to be consented to progress to construction.

This will be the first time the UK government has set regional technology targets and caps and will require developers to assess all pipeline projects against these requirements. It is likely to result in a significant shakeup to the existing project pipeline at various voltage tiers.

It is important to note that the DFES 2024 analysis is based on the FES scenario framework (described in section 2.3) which was published before the 2024 UK general election and before CP30 was announced. Consequently, the technology projections do not reflect, and have not been reconciled to, the CP30 initiative and associated technology allocations.

4.1.3. Grid connection reform

As can be seen in the accompanying technical reports for each licence area, the pipeline of distribution network contracted projects (mainly prospective solar and battery storage sites) in both of SSEN's licence areas has continued to grow significantly. This mirrors the situation across the UK, at both the transmission and distribution levels, and has created a connections queue with far more projects than are required to meet net zero.

To address this, there has been industry dialogue, consultations and proposed policy reform interventions from NESO, Ofgem, Electricity Networks Association (ENA) and UK government to manage the queue of projects seeking to connect to the network. This has already resulted in significant reforms at the transmission network level, with NESO's TMO4+ 'first ready, and needed, first connected' approach to re-assessing the development status of the queue. This will require sites with accepted connection offers to demonstrate evidence of progress in planning, land rights and alignment with CP30 regional technology requirements.

These reforms are likely to have a notable impact on the pipeline of projects looking to connect to SSEN's distribution network, due to developers reprioritising sites, upstream and downstream impacts of transmission constraints to distribution project timelines and a wider range of dormant sites potentially falling away or relinquishing their connection offers.

4.1.4. Planning reform for renewable generation

In July 2024, the UK government announced the removal of the planning restrictions in the National Planning Policy Framework (NPPF) for onshore wind projects in England, that had been in place since 2015.[7] NESO's Clean Power 2030 report recommends that 29% of UK energy generation in 2030 is provided by onshore wind and solar PV.[5] This will require a significant and accelerated deployment of these technologies with a tripling of solar capacity (from 15 GW to 47 GW) and a doubling of onshore wind capacity (from 14 GW to 27 GW) across the UK.

These changes to the NPPF, and the establishment of the UK government's Onshore Wind Industry Taskforce, could lead to new opportunities for a resurgence in onshore wind in England and accelerated deployment for solar projects, reflected in existing pipelines.[8]

4.1.5. Electricity market reform

DESNZ published its second consultation as part of the Review of Electricity Market Arrangements (REMA) in March 2024.[9] With its explicit objectives to make a net zero power system work and accelerate the transition away from unabated fossil fuels, the consultation invited feedback on the potential opportunities to make meaningful market reforms within the existing UK market structure.

REMA is likely to have a notable impact on energy project development and consumer adoption of low-carbon technologies as it looks at how the UK can accelerate the transition away from fossil fuels and direct more investment into flexibility and low-carbon alternatives.

4.2. Key policies for DFES 2024

There are also many policies and targets that are technology specific and have influenced the DFES projections at an individual technology level. Several of the policies that are either new or significant (or both) have been summarised below and further details can be found in the accompanying technical reports for each licence area.

4.2.1. Electricity generation policy highlights

- The results from the Contracts for Difference Auction Round 6 saw the highest-ever budget for a funding round (£1.5bn), supporting 131 clean energy projects with a total capacity of 9.6 GW.[10] Onshore wind and solar PV projects were awarded over £185m. Some projects in SSEN's connection queue were found to have secured AR6 contracts.
- Scotland's Energy Strategy and Just Transition Plan includes an ambition to deploy 20 GW of onshore wind and 4 – 6 GW of solar PV by 2030.[11]

4.2.2. Energy flexibility and storage policy highlights

- The Smart Systems and Flexibility Plan includes an ambition for 30 GW of low-carbon flexible assets by 2030 and 60 GW by 2050.[12] NESO's CP30 advice has also specified storage (short duration and long duration) capacity requirements by 2030 and outlooks to 2035, in reference to this plan.
- There have been two rounds of grant funding to support Long Duration Energy Storage (LDES) technologies, with the majority of the recent Longer Duration Energy Storage (LODES) funding competition winners located in Scotland.[13]
- DESNZ and Ofgem are also looking to implement a new Cap and Floor revenue guarantee mechanism for commercially deployable LDES projects. Consultation on the detailed design of this scheme is due to happen in 2025 and the first contract allocations are proposed to be awarded in 2026.
- The UK government has an ambition for up to 1 GW of electrolytic hydrogen production capacity either in construction or operation by 2025 and offers support via the Hydrogen Allocation Rounds mechanism for low-carbon hydrogen production across the UK.[14]
- The Scottish Government's Hydrogen Action Plan includes a 5 GW target for hydrogen production by 2030 and a 25 GW production target by 2045.[15] In September 2024, £7m in additional funding was made available to Scottish green hydrogen projects.[16]

4.2.3. Sources of energy demand policy highlights

- The UK government has indicated, but not yet formally legislated, that the Zero Emission Vehicle (ZEV) mandate ending the sale of new petrol and diesel cars could revert to 2030.[17] To acknowledge this ambition, but recognise that the policy has not yet been updated, this has been reflected in the **Electric Engagement** DFES scenario only.
- The UK Heat and Buildings strategy includes the ambition to phase-out fossil fuel boilers by 2035 and install 600,000 heat pumps a year by 2028.[18] It also includes the aim for the upfront cost of heat pump installations to be on par with gas boilers by 2030.
- The Scottish Government Heat in Buildings Strategy includes a target for 1 million homes to have low-carbon heating by 2030 and aims for a peak of 200,000 annual installations of zero-carbon heating system by the late-2020s.[19]

Section 5: Supporting studies

The following projects and publications are recent highlights that are either closely related to the DFES analysis or are influenced and informed by the DFES projections.

5.1. SSEN publications

Figure 22 An overview of SSEN's strategic development process (source: SSEN)

A high-level overview of SSEN's strategic development process is shown in Figure 22 and illustrates the role of DFES, and other key publications summarised below, in the network planning process:

- Forecasting the future network need is the starting point of the strategic development process. The DFES analysis is the foundation of this stage, projecting the future generation and demand capacity that might connect to SSEN's distribution network.
- The second stage is to develop a strategic plan and set out high-level options that will enable the projected network demand. A brief overview of SSEN's SDP publications and the associated methodology can be seen in Section 5.1.1.
- The Distribution Networks Options Assessment (DNOA) process is summarised in Section 5.1.2. This is where SSEN develops, analyses and assesses each of the options in detail to determine which best meets the needs of the future network. Different options for strategic network investment are considered, alongside flexibility solutions, and each is assessed appropriately using an industry-approved cost-benefit analysis.
- The final stage in the process is to proactively deliver the chosen network solution that will enable the future network capacity, as first defined in the DFES.

5.1.1. Strategic Development Plans

SSEN's SDPs set out the short- and long-term network needs and high-level options to meet the future demand on the network. Each SDP will cover one of SSEN's GSPs, which are the points where SSEN's distribution network connects to the transmission grid.

The first SDP was published in November 2024 for the Ealing GSP and the rest of the SDPs are set for publication throughout 2025.[20]

The DFES projections inform the likely future network demand and are one of the key inputs into the SDPs. Once the first SDPs have been published for each GSP, they will then be updated annually using the latest DFES forecasts.

Figure 23 SSEN's published SDP for the Ealing GSP (source: SSEN)

SDP Methodology

The SDP methodology document, published in January 2025, outlines the development process for the SDPs and includes further details of how the SDPs interact with both the DFES and DNOA publications.[21]

5.1.2. Distribution Network Options Assessment

The DNOA is the evaluation process that SSEN uses to select the most appropriate method of upgrading the electricity distribution network to ensure it will meet future need. The DNOA process primarily assesses whether procurement of flexibility or strategic network investment is the most appropriate choice on a case-by-case basis. The DFES projections are used to determine the future network requirement which is the basis of the DNOA assessment. SSEN regularly publishes the outcomes of the DNOA process in the DNOA Outcomes report.[22]

Figure 24 SSEN's DNOA Outcomes Report published in March 2024 (source: SSEN)

DNOA Methodology

The DNOA methodology document summarises the step-by-step approach and details how the annual DNOA process links to SSEN's strategic development planning.[23]

5.2. Regen publications

5.2.1. Roadmap to RESP: Unlocking regional ambition

Figure 25 Regen's Roadmap to RESP Report published in May 2024 (source: Regen)

Sponsored by SSEN, this paper explores how the evolution of current processes could unlock regional net zero ambitions and sets out what stakeholders want to see from the RESPs.[24] Through active collaboration with stakeholders, this paper explains how the RESPs could support flexible and collaborative energy planning at a regional level. It also explores how current processes, like those involved in network planning and LAEPs, could adapt to help achieve this goal given that the implementation of the RESP is not expected for some time.

5.2.2. National Infrastructure Commission: Electricity distribution network capacity analysis

The UK government commissioned the National Infrastructure Commission (NIC) to provide a set of recommendations required to make the electricity distribution system ready for net zero.[25] As shown in the DFES analysis, to achieve net zero, the demands on the electricity distribution system will significantly increase. This paper will set out the policy, regulatory and governance changes needed.

Regen, in partnership with EA Technology Ltd, has provided the NIC with research, analysis and modelling to support this study.[26] This has included an analysis of future network needs to achieve net zero, considering several factors and sensitivities, to estimate and assess the investment needed for network and non-network solutions.

Endnotes and references

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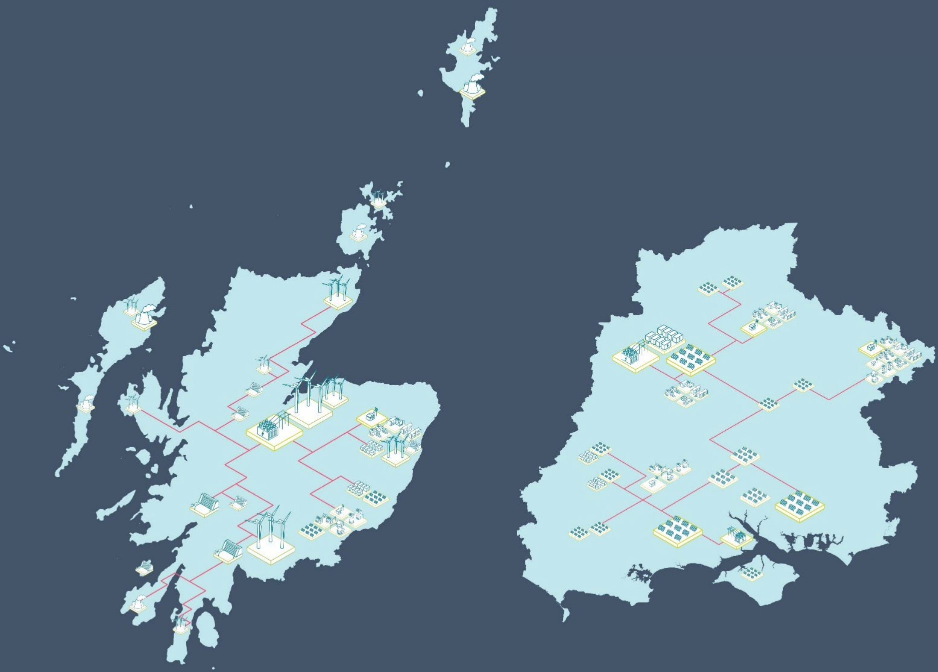

Regen
Bradninch Court,
Castle St,
Exeter
EX4 3PL

01392 494 399
www.regen.co.uk

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