Public

# Strategic Spatial Energy Planning

Technical Webinar

Friday 30 January 2026

Alice Etheridge – Head of Strategic Spatial Energy Planning
Tomas Poffley – SSEP Senior Analysis Manager
Santiago Arango – Economic Analysis Manager
Posy MacRae – Stakeholder Engagement Manager

NESO
National Energy System Operator

**This session will be recorded and slides will be shared.**

**Questions can be submitted to box.ssep@neso.energy**

# Purpose of Today

In November we announced, with the release of new data from DESNZ, that together NESO and DESNZ have taken the decision to **re-run the SSEP modelling.**

Today's webinar will provide **a first look at our updated modelling** and **initial findings**.

# What we're covering:

- **Who we are and why we're here**
- **Strategic Spatial Energy Plan (SSEP)**
    - Latest updates
    - How we are developing the SSEP
    - Our initial findings and trade-offs
    - What we're doing next
- **Q&A**

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# Strategic Energy Planning at NESO

**Alice Etheridge**

Head of Strategic Spatial Energy Planning

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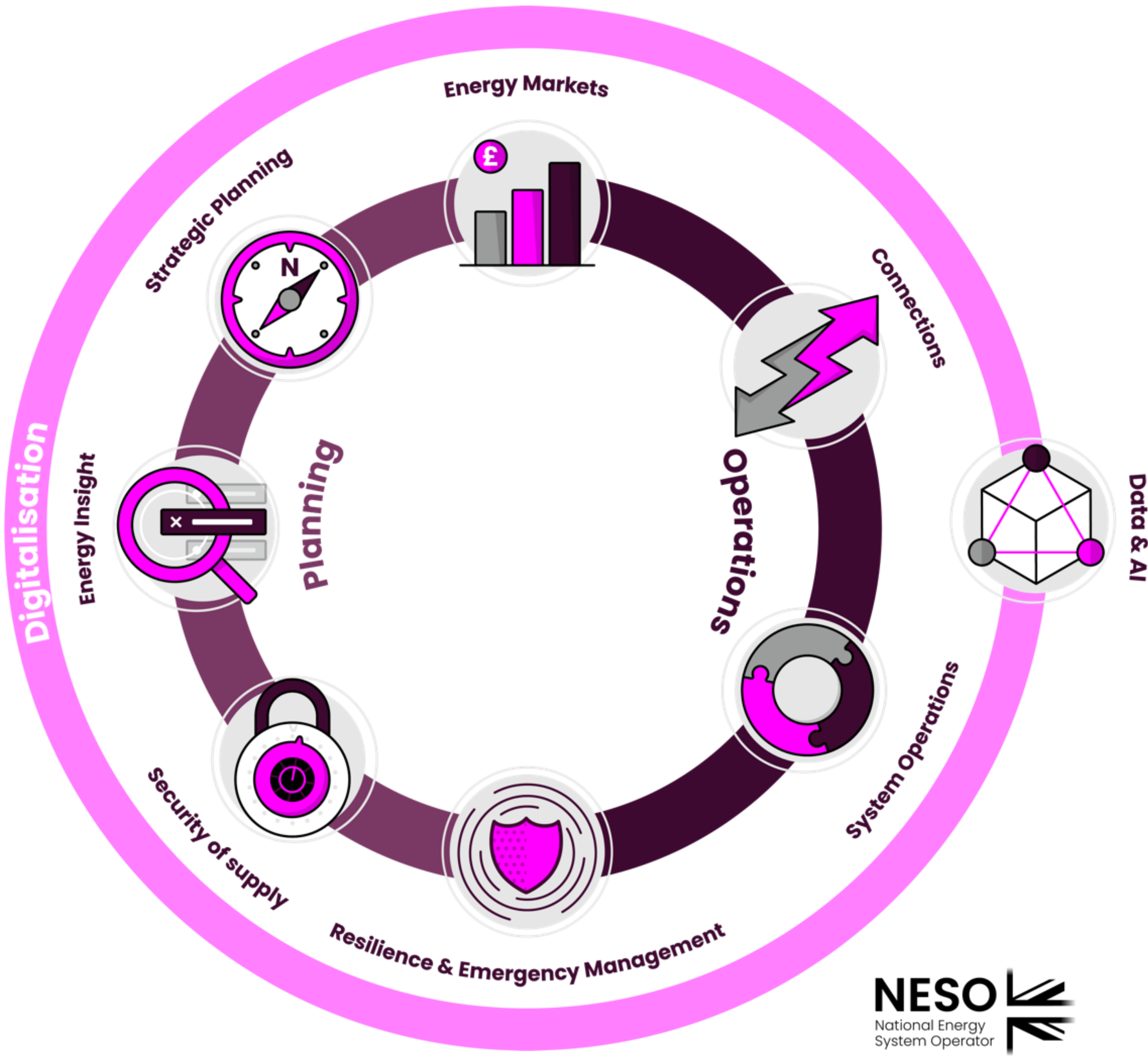
# NESO

We bring together eight activities required to deliver the plans, markets and operations of the energy system of today and the future.

Bringing these activities together in one organisation encourages holistic thinking on the most cost-efficient and sustainable solutions to the needs of our customers.

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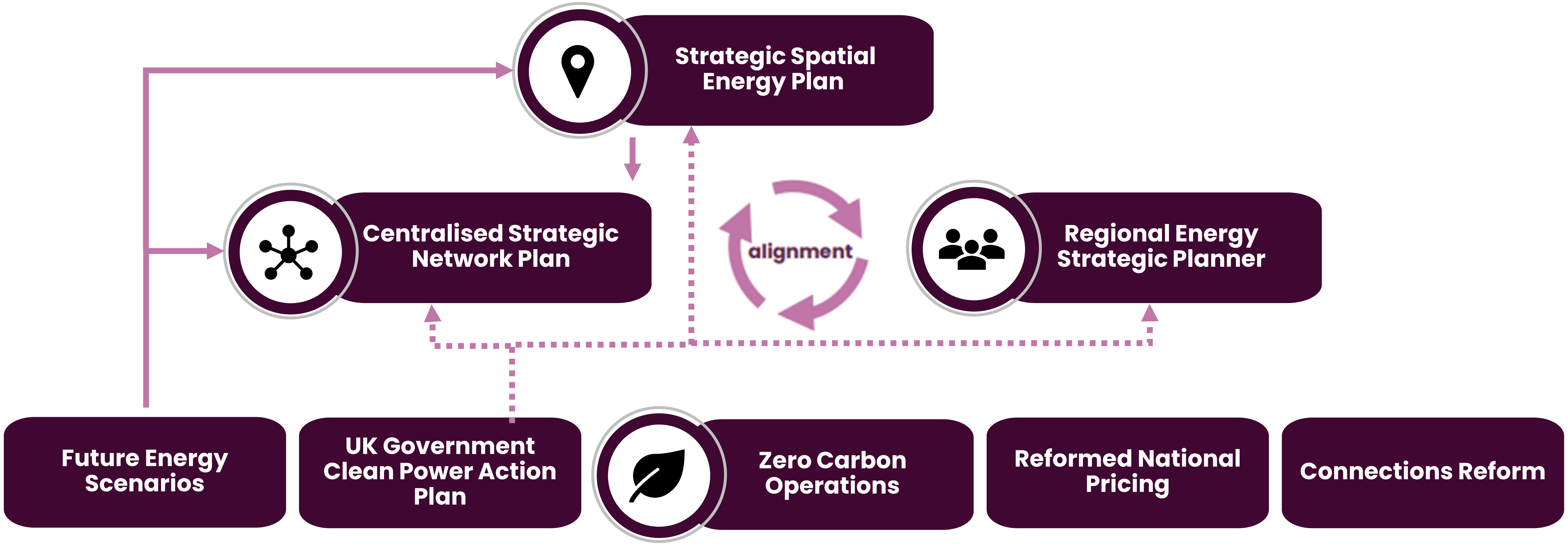
# Strategic Energy Planning

For the first time, we will coordinate system design and planning across the entire energy sector, enabling planning and investment decisions to be optimised in support of Great Britain's net zero goals, while ensuring the most equitable cost to consumers.

# The Wider Context

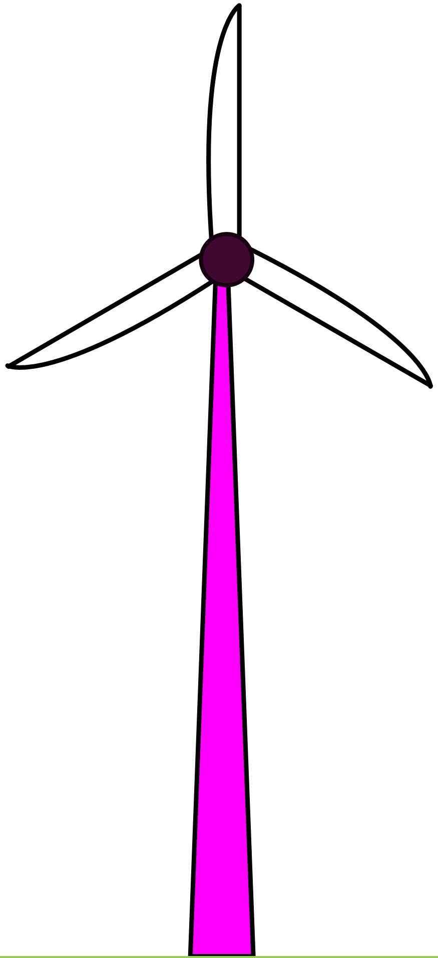


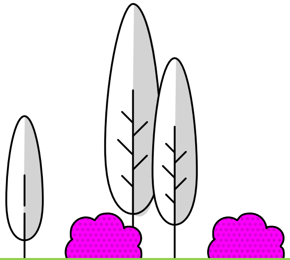
# Strategic Spatial Energy Plan

The SSEP will accelerate clean, affordable and secure energy through greater certainty.

The plan will assess the locations for electricity generation, and storage of electricity and hydrogen on a zonal basis.

This will provide a government and Ofgem-endorsed plan that firmly sets the context for the nation’s energy requirement.





# SSEP key dates and milestones

**December 2024**
Launched SSEP draft methodology consultation

**January 2025**
Close of draft methodology consultation

**May 2025**
Final methodology published

Iterative modelling ongoing

**Summer 2026**
4-6 pathway options submitted to UK Energy Secretary

**Early 2027**
Draft SSEP consultation period

**Autumn 2027**
First SSEP published for GB

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# SSEP Delivery

Prepare → Model → Appraise → Consult → Refine → Publish

Stakeholder engagement

Environment

Assurance

Governance

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# How are we developing the SSEP?

## Our economic and geospatial modelling

**Tomas Poffley**
SSEP Senior Analysis Manager
**Santiago Arango**
Economic Analysis Manager

# Modelling in the SSEP

**The SSEP uses economic modelling and geospatial assessments to assess the best place to put new electricity and hydrogen generation and storage technologies.**

**Economic**

Simulates and analyses the operation and evolution of the energy system based on cost.

**Geospatial**

Mapping spatial exclusions, constraints and opportunities to identify potential developable areas.

Throughout the modelling process, economic and geospatial assessments are iterated to deliver a balanced outcome.

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# Reminder: Economic Model Set-up

## Inputs and dependencies

**Demand projections**

**Geospatial inputs**
What can be built where?

**Baseline**
What is our starting point?

**Deliverability constraints**
How quickly can we build?

**Economic modelling**

**Macroeconomic inputs**
Commodity prices, interest rates, ...

**Techno-economic inputs**
Build costs, efficiencies...

**Policy levers**
UK/Scottish/Welsh government ambitions

**Geospatial Modelling**
Spatial Evaluation Framework
Spatial Assessment
Environmental Assessments

# Sophisticated optimisation model

Behind the analysis and insights …

… sits a **large, feature-rich optimisation model** that manages many system complexities.

The model **minimises total system cost** out to 2050, with explicit representation of hourly system dynamics, and features a very large set of optimisation variables and constraints

## Technology choices

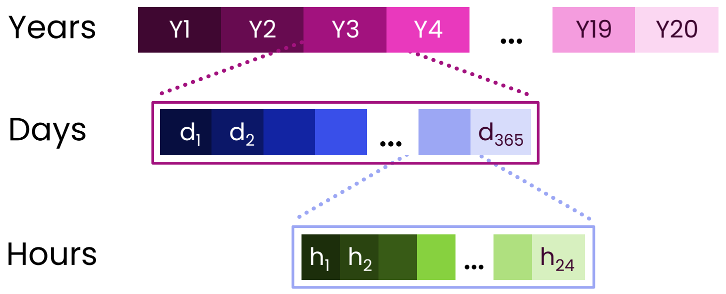
Optimises across electricity and hydrogen generation, storage, and transmission, covering **20+ in scope technology choices**

**Generation**
**H2 transport**
**Networks**
**H2 storage**
**Storage**
**H2 production**
**Demand flex**

## Spatial granularity

Represents the system across **17 economic land zones**, reflecting both electricity and hydrogen network constraints, **19 marine zones**, and interconnection with **7 neighbouring countries**

## Temporal granularity




Optimises over a **20-year horizon**, with explicit representation of **hourly system dynamics** across GB and connected European markets

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# Achieving a balanced spatial distribution of technologies

## Economic model

Estimates system costs and technology volumes

## Spatial model

Defines zonal technology ranges against SEF[1] indicators

Least cost

SEF Optimal


Driven by most economic outcome

Driven by spatial suitability (least constrained, most opportune)

## Stakeholder informed

Stakeholder perspective on feasibility and impacts where possible

### 1 Least-cost distribution

Least spatially constrained and most cost optimal system solution. Determines optimal technology capacities under loose land restrictions.

### 2 SEF-optimal distribution

SEF-optimal technology cut-offs identified for least-cost volumes (least-cost distribution). Re-calculating of costs and volumes using economic model.

### 3 Pillar-informed distribution

Spatial pillar indicator thresholds, zonal land-take limits, and zonal build limits are identified and converted into cut-offs. These are translated into cut-offs, then cost and volumes are re-calculated.

### Balanced distribution

Pathways are balanced against cost-led, spatially-optimised and stakeholder-informed outcomes

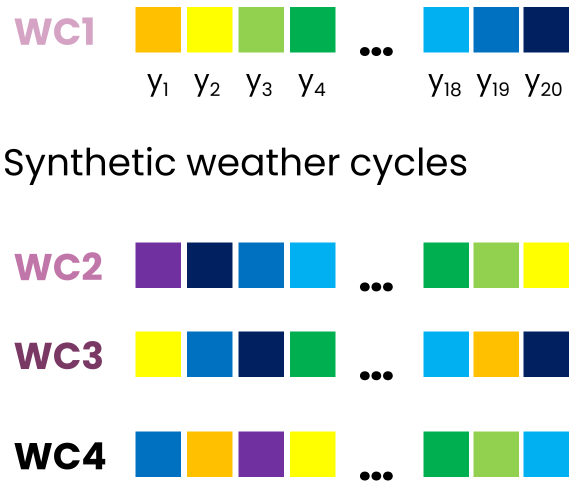
1 – Spatial Evaluation Framework

# Weather cycles and security of supply

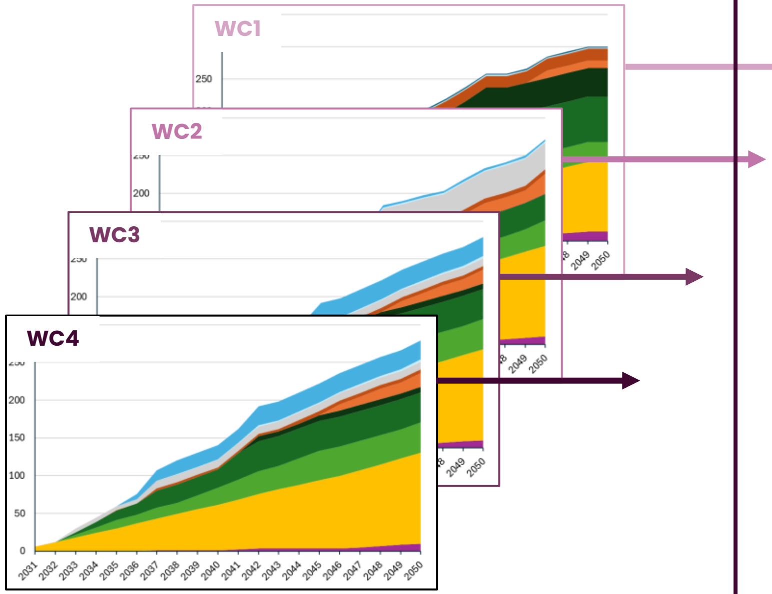
## Weather cycles

Historical weather cycle (WC)

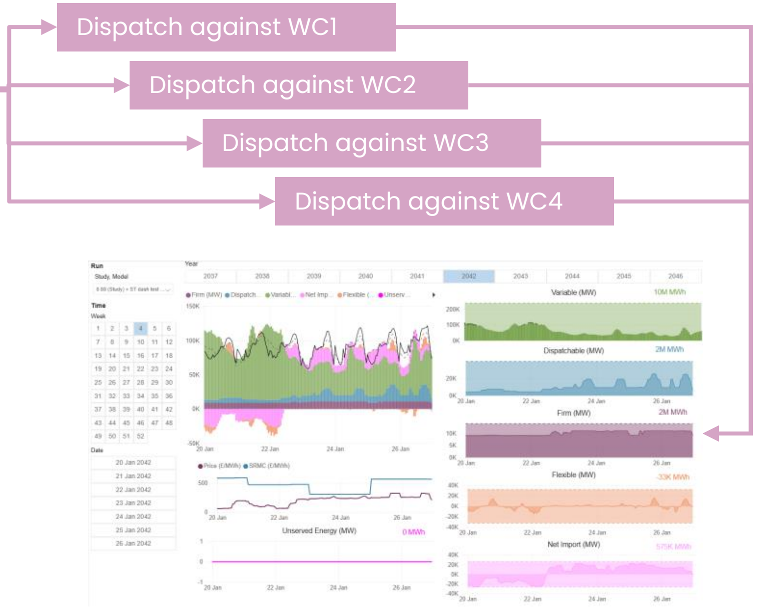
Synthetic weather cycles




## System optimisation




## System dispatch




We use a mix of historical and synthetic weather years to represent variability in demand and renewable generation.

These weather cycles capture uncertainty in key inputs that materially affect system outcomes.

Optimising the system across multiple weather conditions ensures capacity build-out is not driven by a single weather year, but is resilient to a range of plausible future conditions

Each pathway is tested through detailed dispatch modelling against multiple weather years and varying plant availability conditions.

This allows us to assess operational feasibility and security of supply and ensure the system performs reliably.

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# Uncertainty, robustness and capacity ranges

Capacity ranges for in scope technologies are informed through structured robustness testing around a **single, internally consistent planning demand trajectory**. The framework focuses on identifying and testing uncertainties that can change technology choices, locations and timings rather than uncertainties that rescale the system.

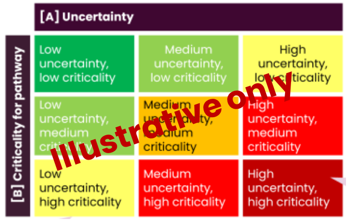
### Planning demand trajectory

Anchor analysis on single demand trajectory to ensure internal consistency across model runs

### 1 Select decision relevant uncertainties

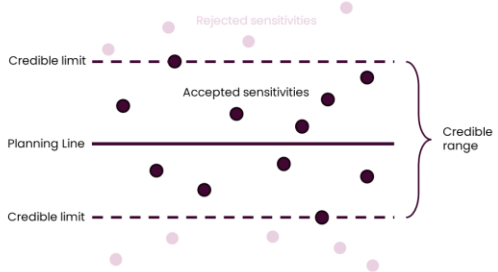

Prioritise uncertainties that could change capacity mix, spatial deployment, system operability rather than those that uniformly scale total capacity (costs, build rates, fuels, emissions, weather …)

### 2 Prioritise robustness testing




Sequence tests based on ability to materially influence outcomes and planning decisions

### Sensitivity results




Resulting capacity spread from this robustness tests informs the reported capacity ranges

**Demand uncertainty that affects system behaviour** (weather variability, demand flex uptake, load shape) is considered in this framework.

**Structural shifts in fundamental demand** (+-5% change in total demand growth) are explored separately, as they rescale system size rather than reveal which capacity outcomes are robust.

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# Pathway Development

**Tomas Poffley**

SSEP Senior Analysis Manager

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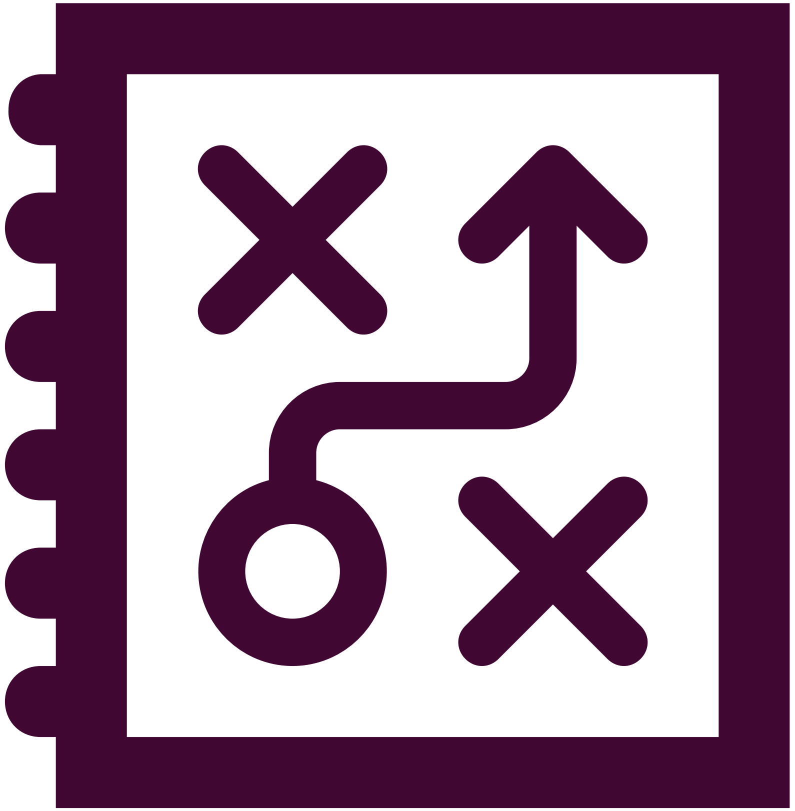
# Pathways:

**Plausible future energy system configurations.**

Representing **different combinations** of technologies, locations, capacities and timings that meet GB's future energy needs.

While **balancing** cost, spatial impacts, environmental constraints, societal considerations and policy ambitions.



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# Modelling and Pathways Process

| | | | | |
|---|---|---|---|---|
| **Key Milestones** | **Pathway longlist** Longlist of balanced pathways prepared for down-selection | **Draft Pathways** Shortlist of 4-6 pathway options for further assessment and refinement | **Final Pathways** 4-6 Appraised pathway options represented in Pathway Options Report | **Pathway Options Report** Representation of 4-6 pathways. Submitted to UK Energy Secretary in Summer 2026 |
| **Activity** | We are here: **Pathway Development** | **Pathway Down-Selection** | **Appraisal of Draft Pathways** | **Pathway Options Report drafting** |

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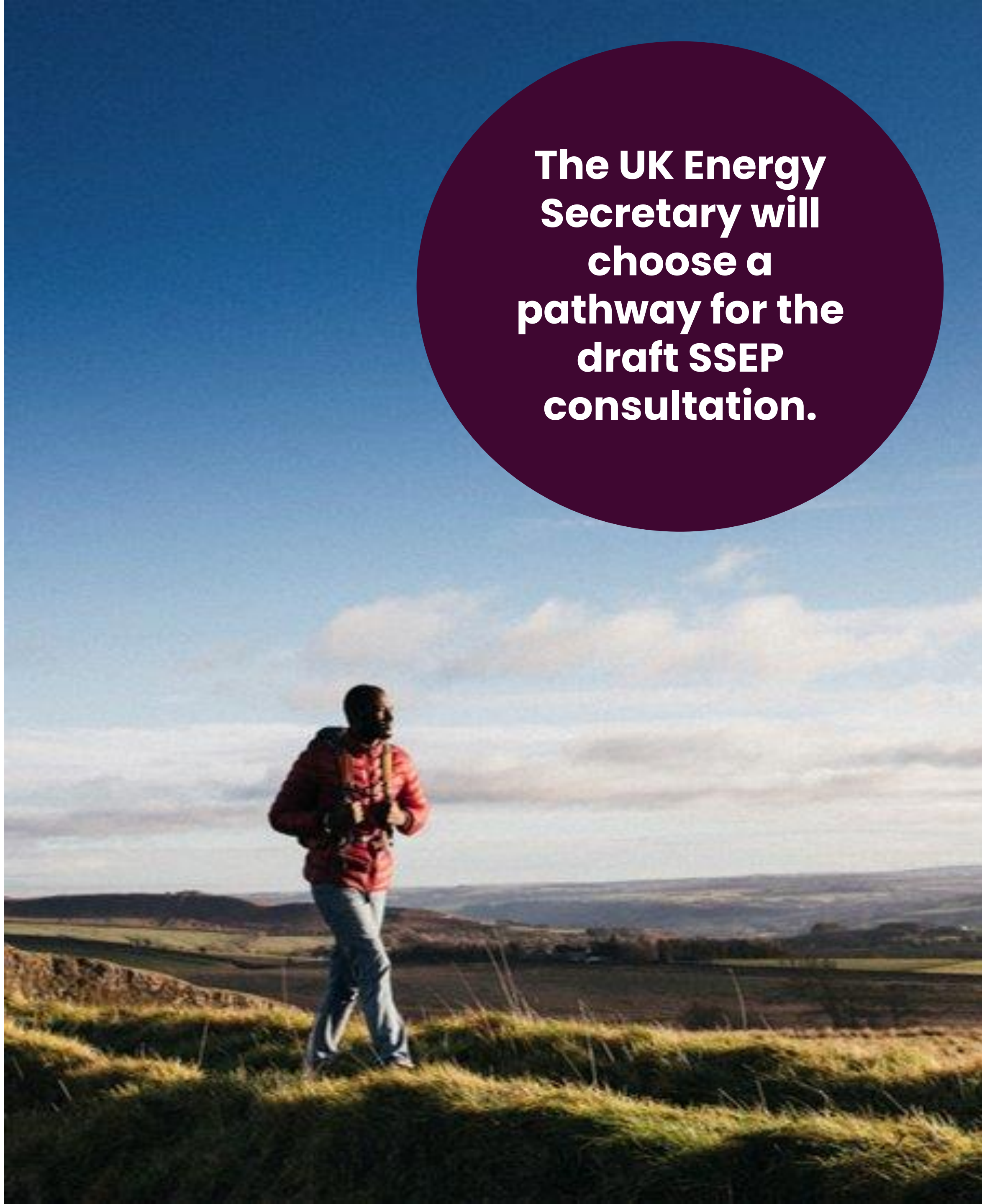
# How are we choosing pathways?

**All pathways will be designed to achieve net zero by 2050 and establish a secure energy system in GB.**

- We begin by **creating a longlist of potential pathways**.
- Ensure inclusion of a **'low regrets' pathway**, reflecting elements that remain robust across multiple plausible futures.
- Expand pathway themes into **branches** to test a broader range of variables and sensitivities.
- For each pathway theme, there is likely to be several ways that the theme may be achieved.
- We use a **Strategic Spread framework** to ensure we consider a balanced and comprehensive range of strategic options.
- Apply a structured **down-selection process** to identify **4-6 final pathway options** for presentation to the UK Energy Secretary.



# Pathways Strategic Spread

**The Strategic Spread framework allows us to ensure we are considering a range of pathways across the full spectrum of generation and energy system options.**

| | Low Carbon Dispatchable (LCD) | Renewables |
|---|---|---|
| **High Green Gas** | Gas plant with biomethane<br>Nuclear<br>Gas CCUS<br>BECCS<br>H2P<br>High H2 production<br>High biomethane availability for the power sector | Onshore wind<br>Offshore wind<br>Solar<br>High H2 production<br>High biomethane availability for the power sector |
| **Low Green Gas** | Nuclear<br>Gas CCUS<br>BECCS<br>H2P<br>Low H2 production<br>Low biomethane availability for the power sector | Onshore wind<br>Offshore wind<br>Solar<br>Low H2 production<br>Low biomethane availability for the power sector |

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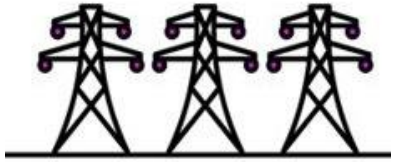
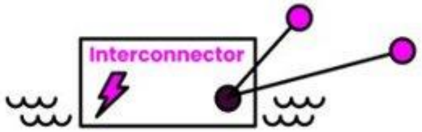
# Strategic Spread: Cross cutting components

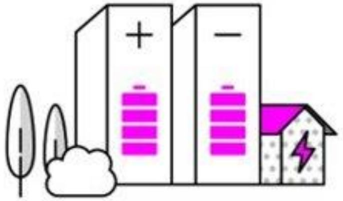
There are several cross-cutting components of the energy system that have been raised as critical to the definition of pathways but do not easily fall into one of the Strategic Spread quadrants.



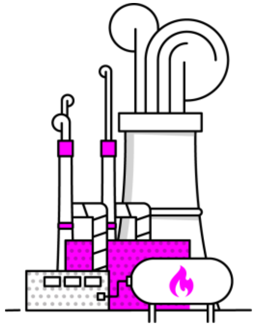
**Electricity networks**




**Interconnectors**



**Storage**
**(Long duration energy storage and batteries)**



**Unabated gas**

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# Updated pathway themes

## January 2026:

1. Base Run
2. Lower reliance on nascent technologies
3. Reduced impact on land
4. Lower reliance on unabated gas
5. Higher low carbon dispatchable power

# Modelling Findings

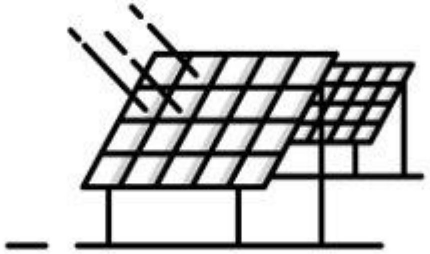
**Santiago Arango**
Economic Analysis Manager

# Early SSEP modelling findings

These findings **do not yet consider geospatial modelling or the spatial feasibility of deploying certain types of technologies.**

**Please note our SSEP modelling is ongoing**, with the results maturing and evolving.

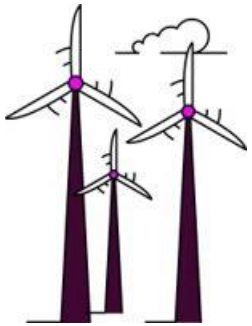
# Modelling findings and insights



**Solar** is the economically preferred technology.

The economic model almost always builds the maximum allowed (limited by the annual build rate) driven by cost effectiveness and deployment rate.

Early modelling outcomes indicate that more solar means less floating offshore wind and hydrogen to power, but it has little impact on the majority of other deployed technologies.



Although the model deploys different **wind** technologies in different conditions, total new wind capacity is very consistent across our exploratory sensitivity work.

In most of our exploratory modelling so far, wind deployment favours onshore over offshore. The economic model usually builds floating offshore wind in smaller quantities when compared to fixed offshore wind.

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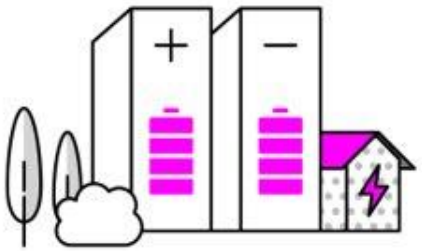
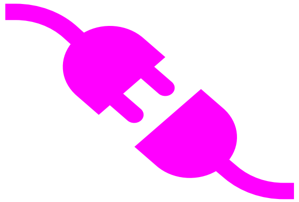
# Modelling findings and insights



**Batteries** and electrolysers are built in economic modelling zones where there are high levels of renewable generation.

Storage plays a key role in enabling renewables. Battery capacity is strongly correlated with solar capacity.

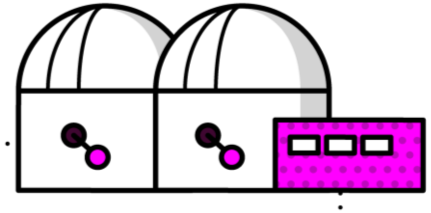
**Long duration energy storage (LDES)** expansion is relatively stable in sensitivities where other technology types are limited except for when limits are imposed upon unabated natural gas, in which LDES capacity expansion more than doubles.



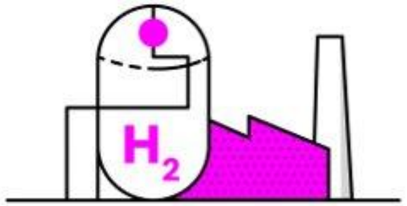
**Interconnector** (IC) capacity continues to be a critical technology in our modelling, and the baseline reflects CP30 assumptions. In sensitivities where interconnector capacity is reduced, the system requires additional sources of flexibility to be built in GB to compensate for less IC capacity available during periods of system stress.

Recent modelling indicates that renewables remain responsive to interconnector capacity, but the effect is now more muted than in earlier assessments.

# Modelling findings and insights



**Gas and/or hydrogen** support an electricity system dominated by renewables. Gas capacity is a consistent feature of our exploratory sensitivity work and plays a key role in providing flexibility when there are strict decarbonisation limits.



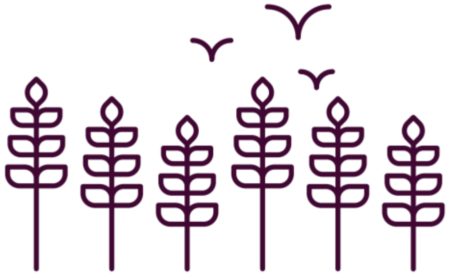

If gas capacity is restricted, **hydrogen to power (H2P)** is built as an alternative, with corresponding increases in hydrogen electrolyser, storage and transmission assets.

Increasing levels of hydrogen assets often result in a reduction in the amount of nuclear Small Modular Reactors (SMR) build.

Hydrogen (H2) assets are amongst the most sensitive to changes in other technologies:

Less renewables capacity leads to less H2 production and storage

Less electricity network leads to more H2 production and storage to absorb excess renewable power.



**Bioenergy with Carbon Capture and Storage (BECCS)** always builds to meet the emissions target, as it is the only technology that can provide negative emissions.



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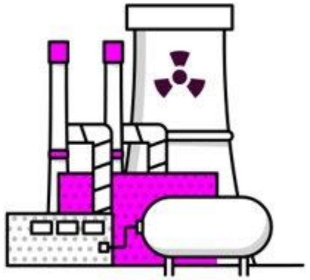
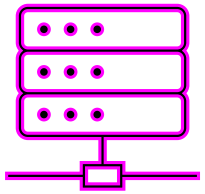
# Modelling findings and insights

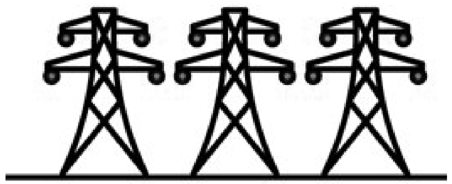


Across our exploratory sensitivity work, **nuclear** shows low-medium variation of deployment rate. Small Modular Reactors (SMR) are chosen rather than large scale nuclear in the modelling, because SMR has lower cost assumptions.

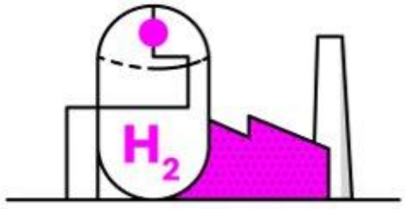


Locationally flexible datacentres are consistently located in zones with high levels of renewables and lower demand. As outlined in the methodology, we are only spatially optimising a small volume of **flexible data centre demand** (1-2GW)

# Modelling findings and insights



Further development of the **electricity network** is required to move electricity across electrical boundaries and export high levels of new renewable capacity into different GB zones.




Development of a **hydrogen network** to support the electricity system is evident in most modelling runs. This could be in localised areas or GB-wide. It often involves building hydrogen transmission capacity from areas of electrolyser capacity (which is located close to renewable generation) to hydrogen storage areas (which are geologically limited).

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# Next stages

Geospatial and Appraise

**Tomas Poffley**

SSEP Senior Analysis Manager

NESO National Energy System Operator

# Spatial Assessments

Our **Spatial Evaluation Framework (SEF)** identifies areas that are potentially suitable for energy infrastructure development, while excluding those that are not. This is assessed through spatial indicators that are classified as either a **spatial exclusion, constraint or opportunity.**

We’ve complied a list of spatial indicators over **four pillars**:

- Environment
- Societal
- Technical Engineering Design Requirements
- Other Spatial Uses

We’ll now be carrying out a **Spatial Assessment** which works iteratively across the four pillars to achieve a balanced outcome that:

- **minimises costs**
- **maximises potentially developable areas**
- **while ensuring pathways do not have an unacceptable spatial impact**

Engagement with working groups informed the SEF.

The full list of indictors being considered can be downloaded here: neso.energy/document/371256/download

# Appraisal of SSEP Pathways

Appraise is:

- A technical assessments to **review, challenge and refine our draft pathways and provide understanding for the Pathway Options Report.**
- Guided by key principles - **minimising economic and spatial impact** and the ability to meet **future policy ambitions.**

The Appraise process has been designed by identifying criteria that ensure a pathway is viable, deliverable and robust.

- Aligned with other spatial plans
- Delivers decarbonisation
- Creates a resilient future energy system
- Enables the Centralised Strategic Network Plan
- Socially and environmentally deliverable
- Minimises spatial impact
- Practically deliverable – build rates and supply chain
- Economically feasible
- Meeting or accelerating progress to published carbon budget targets
- Delivers a secure and operable system
- Feasible within the Policy Framework

***Not exhaustive**

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# How to get involved

**Posy MacRae**

Stakeholder Engagement Manager

# How to get involved

- We'll continue to run **public webinars** to provide key updates, listen to your feedback and answer questions.
- We're releasing quarterly **data transparency updates**. To share our data and sources.
- We're collaborating closely with **existing working groups and forums**.
- Further energy **developer workshops** are being planned for the spring.
- **Meeting summaries** are shared on our website to highlight key discussion points.

**Further resources:**

- SSEP Final Methodology published May 2025
- SSEP Transparency Update published November 2025
- Visit our SSEP webpage for the latest news
- **Email us at box.ssep@neso.energy**

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# Thank you for joining

**box.ssep@neso.energy**

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