

STRATEGIC TRANSMISSION PLANNING

Energy transition • GB–Chile learning

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Decarbonisation Changes the Planning Problem

The Old Trigger

Visible congestion → reactive reinforcement.
Wait until the problem is undeniable, then respond.

The New Trigger

The future system we need to enable → **proactive planning**. Build ahead of certain need.

- Renewable generation is often far from demand centres
- Transmission takes many years to plan, consent and construct
- If we wait until need is certain, infrastructure arrives too late
- **Transmission becomes a strategic enabler, not just a connector**



Different Systems — Shared Strategic Challenges



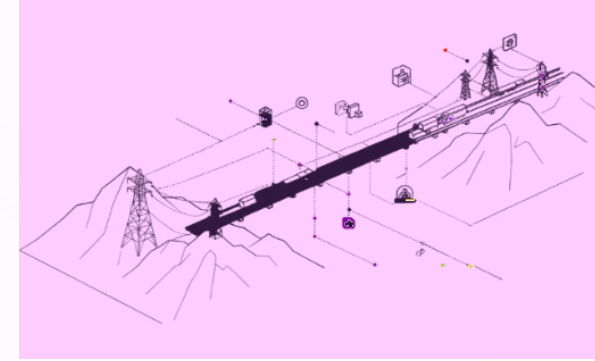
Chile

- World-class solar in the north (Atacama)
- Significant wind, hydro resources
- Central demand · Major mining load



Great Britain

- Offshore wind at distance (Scotland, North Sea)
- Southern demand concentration
- Island-system operability constraints

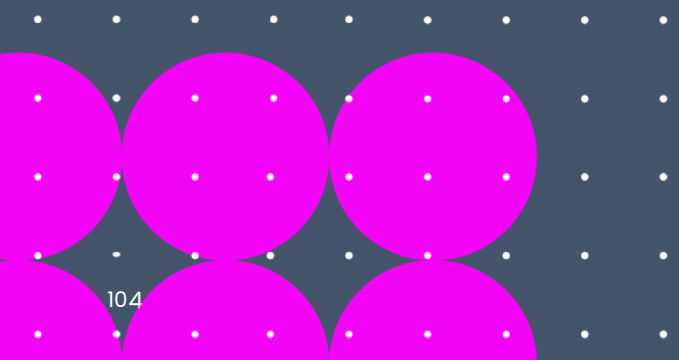


The Shared challenge

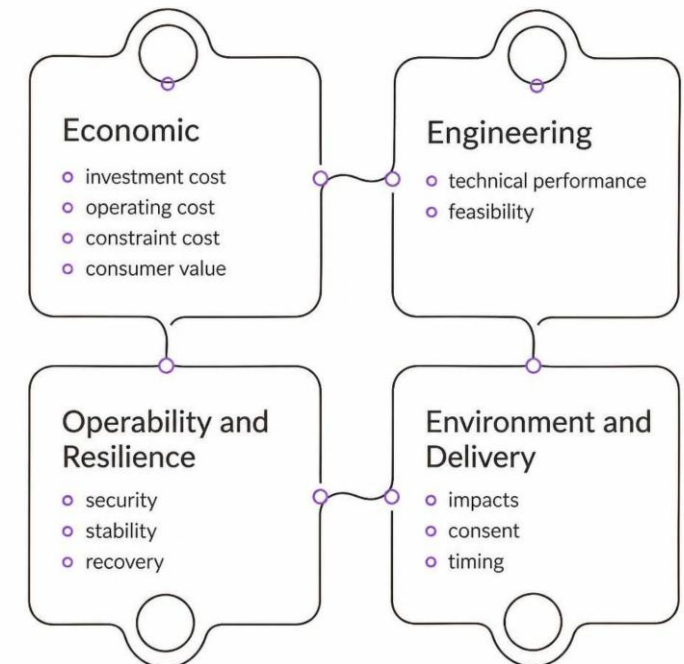
- Best resources far from demand
- Long corridors · Congestion · Curtailment
- Difficult investment decisions

❏ **Three questions both countries wrestle with:** When should we build? How much should we build? When should we use flexibility, storage or operational solutions instead?

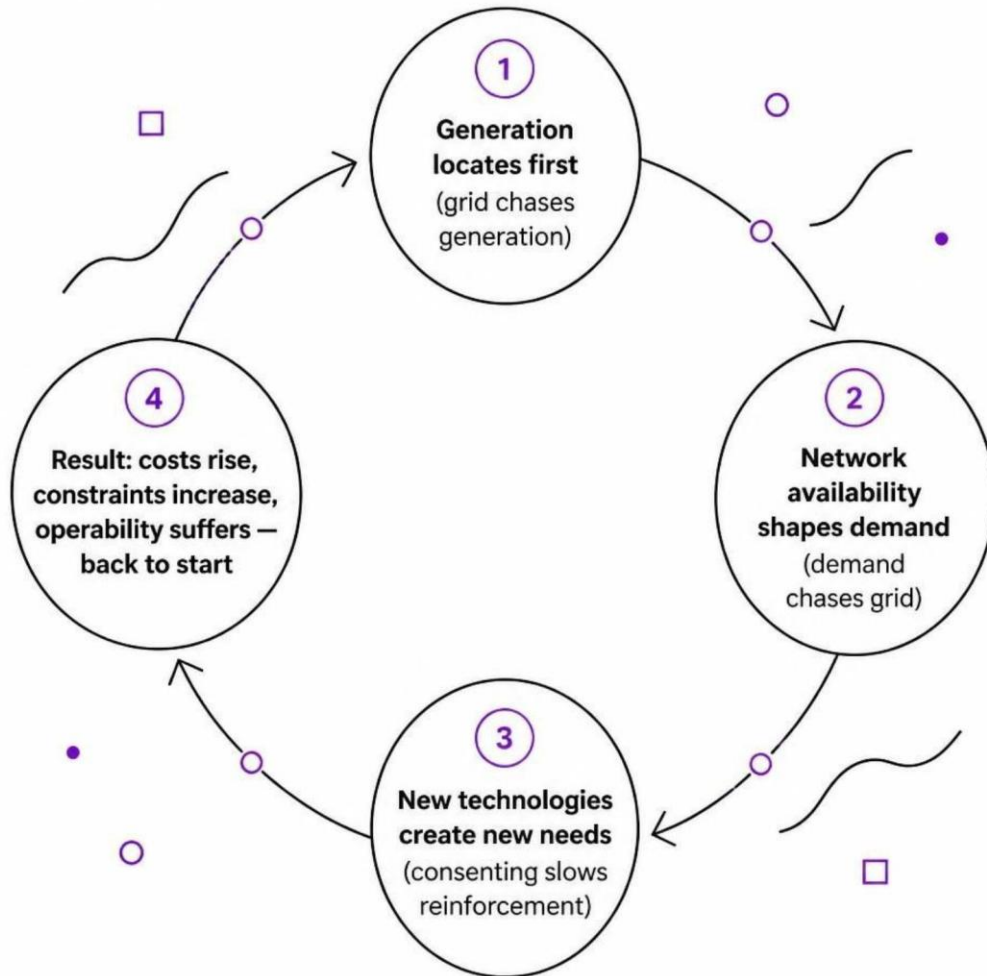
How Greate Britain Has Approached The Problem



From Future Energy Scenarios to Network Investment



The Traditional Approach: A Cycle of Declining Outcomes



Why the cycle fails

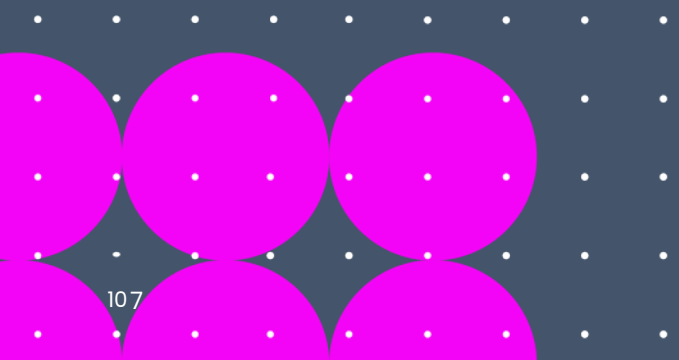
Each part of the system **reacts** to others rather than being planned coherently.

Higher costs
Avoidable constraint and balancing costs accumulate

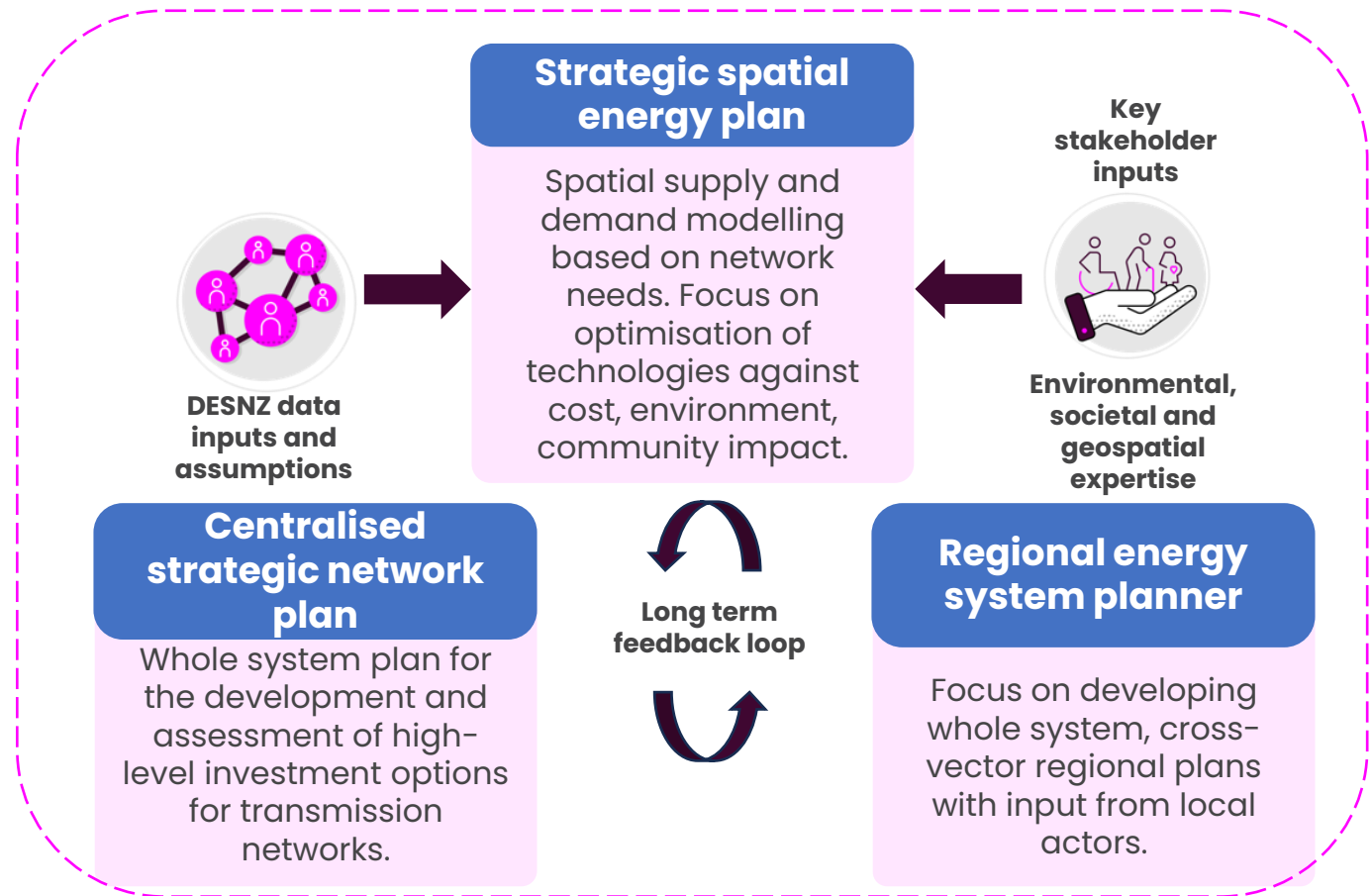
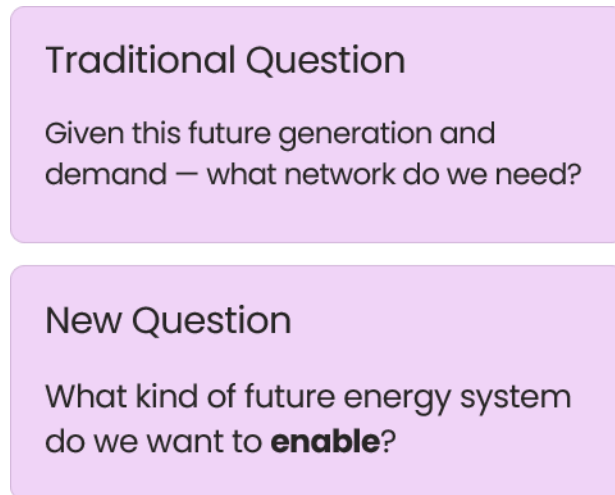
Poorer outcomes
Consumers bear the cost of reactive, disjointed decisions

Delivery pressure
Late infrastructure increases consenting and construction risk

Is There A Better Way!?



Moving Upstream: From Responding to Futures to Shaping the Future System



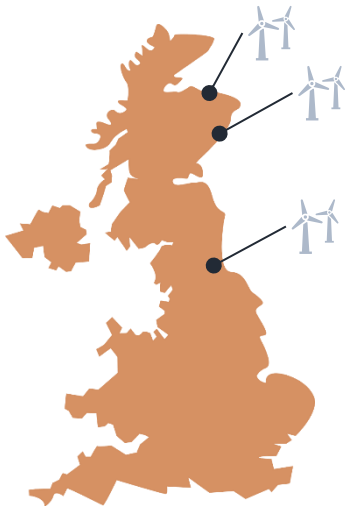
The philosophy: Move from responding later to shaping earlier — coordinate infrastructure around the future system we want to enable.

Holistic Network Design (HND)

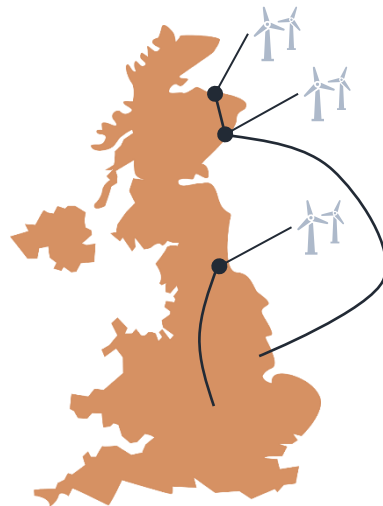
Strategic planning of offshore and onshore infrastructure

Fit and Connect Approach

Each wind farm is offered its own connection to shore. No up front consideration of environment, community etc.



Later, the necessary onshore network reinforcements are developed.

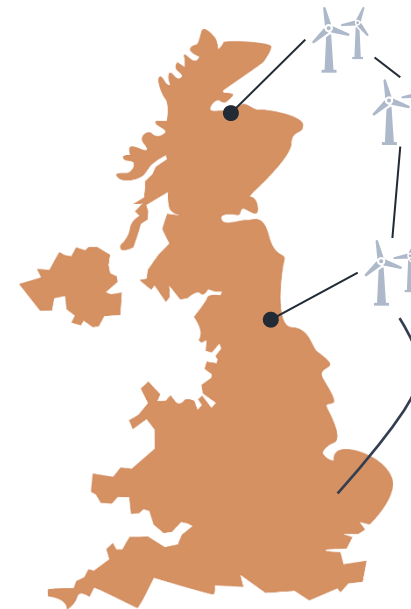


Design of Networks and Generation Together

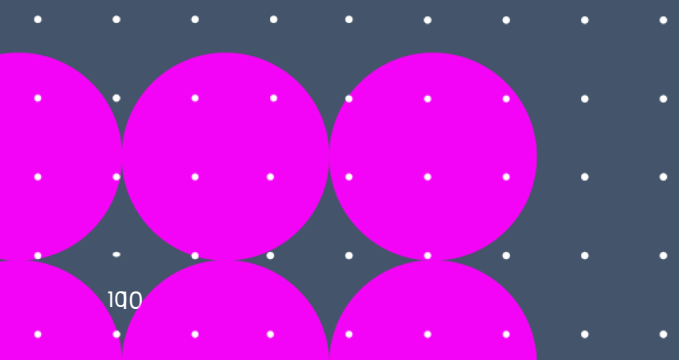
The connections for all wind farms are considered together, including opportunities for coordination.

The designer recommends different connection locations in order to bring the energy closer to where it is needed.

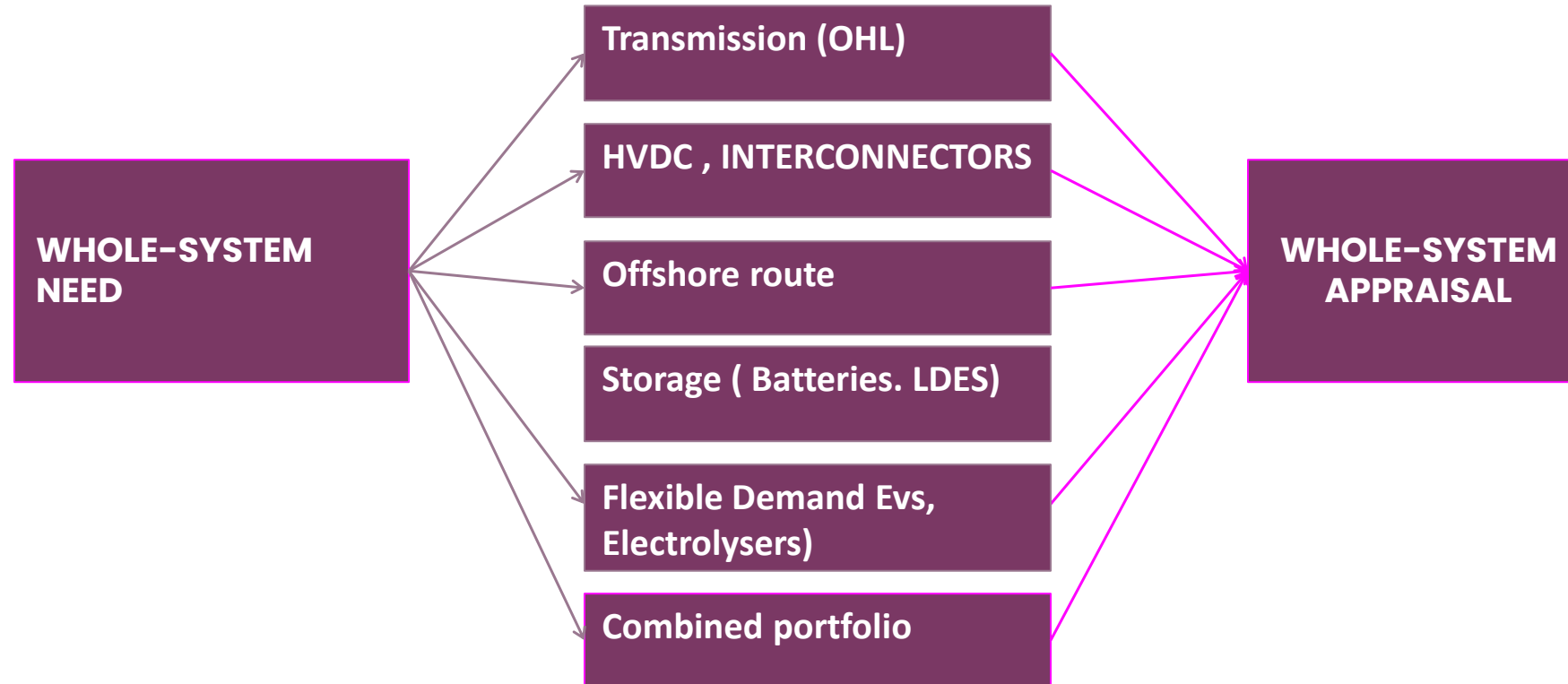
The onshore network is planned alongside the connections for offshore wind projects.



What Is The Right Solution?



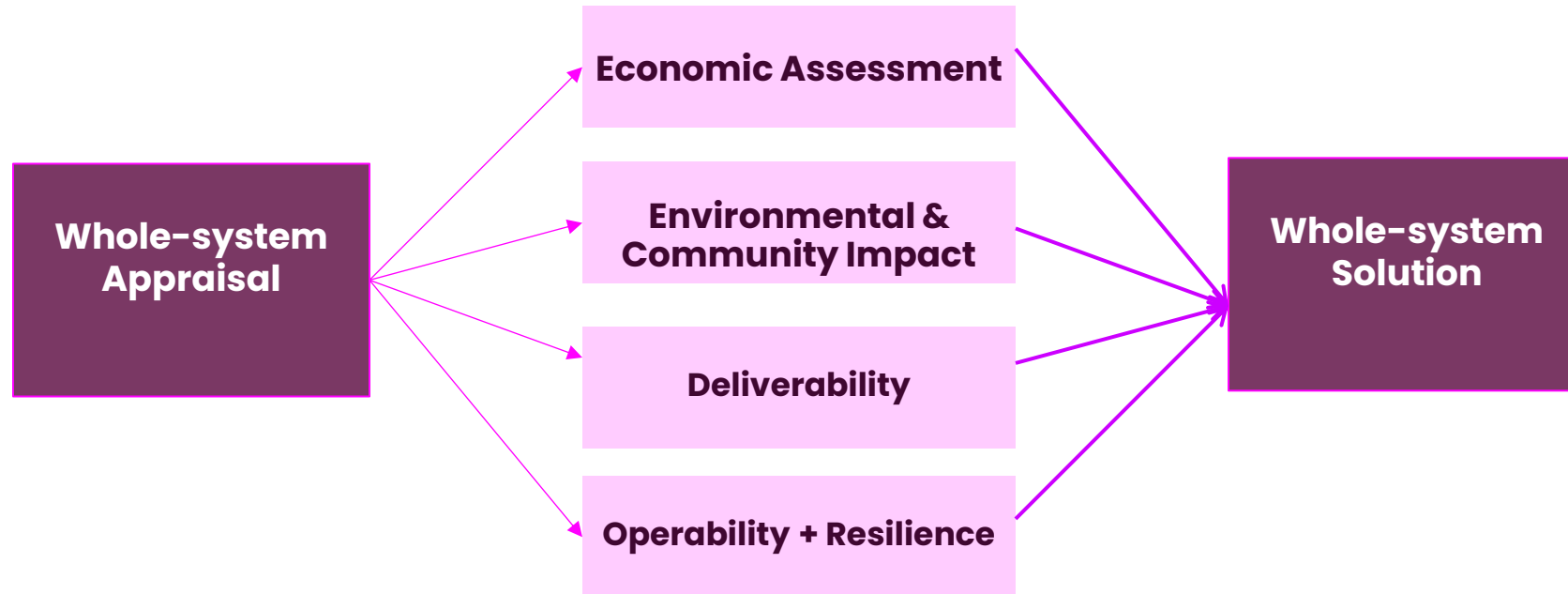
From “What Should We Build?” to “What Is the Best Whole-System Solution?”



Not “which asset is cheapest?” — which portfolio creates the best long-term outcome?

Whole-system appraisal

Define the system need first. Let infrastructure, flexibility and combinations compete on the same outcome.



Not “which asset is cheapest?” — which portfolio creates the best long-term outcome?

Clean Power 2030: Whole-System Planning in Practice

Six Technical Elements + Four Delivery Enablers

Six Technical Elements

Electricity Supply

Clean generation at scale

Demand Flexibility

**Shift demand to match
variable renewable output**

Networks

**Move power where it is
needed**

Connections

**Reform and accelerate
access**

Operability

**Stability, voltage, and
resilience**

System Operation

**Secure, efficient running of
the network**

Four Delivery Enablers

Planning & Consenting

Finance & Markets

Supply Chains & Skills

Governance &
Coordination

Network and flexibility must advance together



TRANSMISSION CAPACITY

Move clean power from where it is generated to where it is needed — and deliver reinforcement on time.



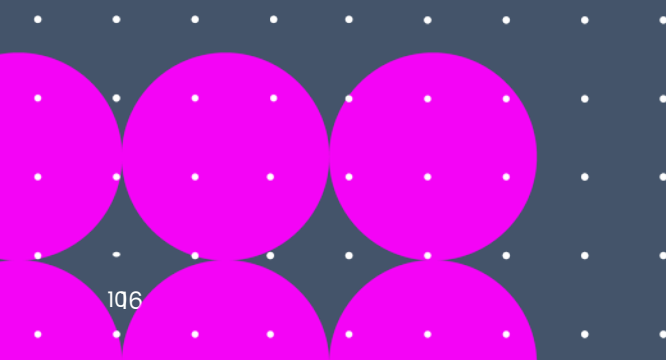
FLEXIBILITY PORTFOLIO

Batteries • long-duration storage • interconnection • flexible demand

Beyond 2030 reconfirms the overall transmission need.

Each constraint still requires a decision: when to build, how much to build, and when to use other solutions instead.

Importance of Certainty and its impact on cost and delivery.



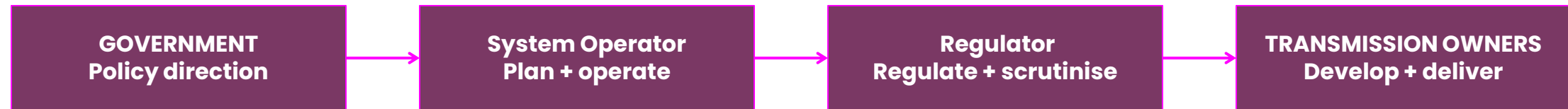
Importance of Certainty

Policy Certainty Leads to Better Outcomes



A Good Plan Only Creates Value If It Can Be Delivered

Strategic value reaches consumers only when connections and infrastructure arrive in the right sequence.



CONNECTIONS REFORM

Queue position → Readiness + strategic alignment

DELIVERY CRITICAL PATH

- CONSENT
- COMMUNITIES
- DATE CHANGES
- SUPPLY CHAIN
- CONSTRUCTION

WHEN A DELIVERY DATE MOVES, THE VALUE OF THE PORTFOLIO MOVES WITH IT

GB and Chile: What Can We Learn From Each Other?

GB

- Offshore wind at distance
- Island-system operability
- Data centres + electrolyzers

**PLAN EARLIER
COORDINATE
ADAPT**

CHILE

- Long transmission corridors
- Solar, congestion + curtailment
- Concentrated mining demand

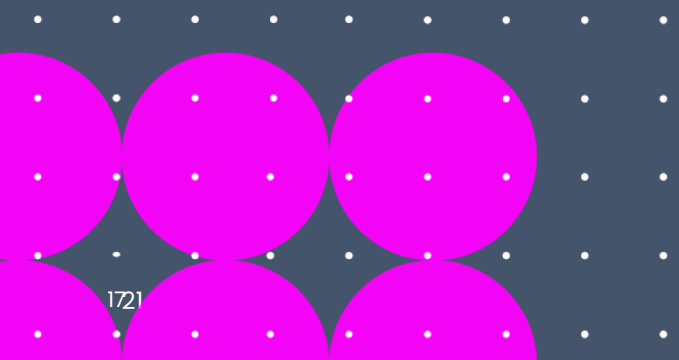
● CONSUMER VALUE ● SECURITY ● OPERABILITY + RESILIENCE ● DELIVERABILITY

Find the right combination of infrastructure, flexibility and operational solutions.

Thank you

public

Annex



Pathways not a Plan

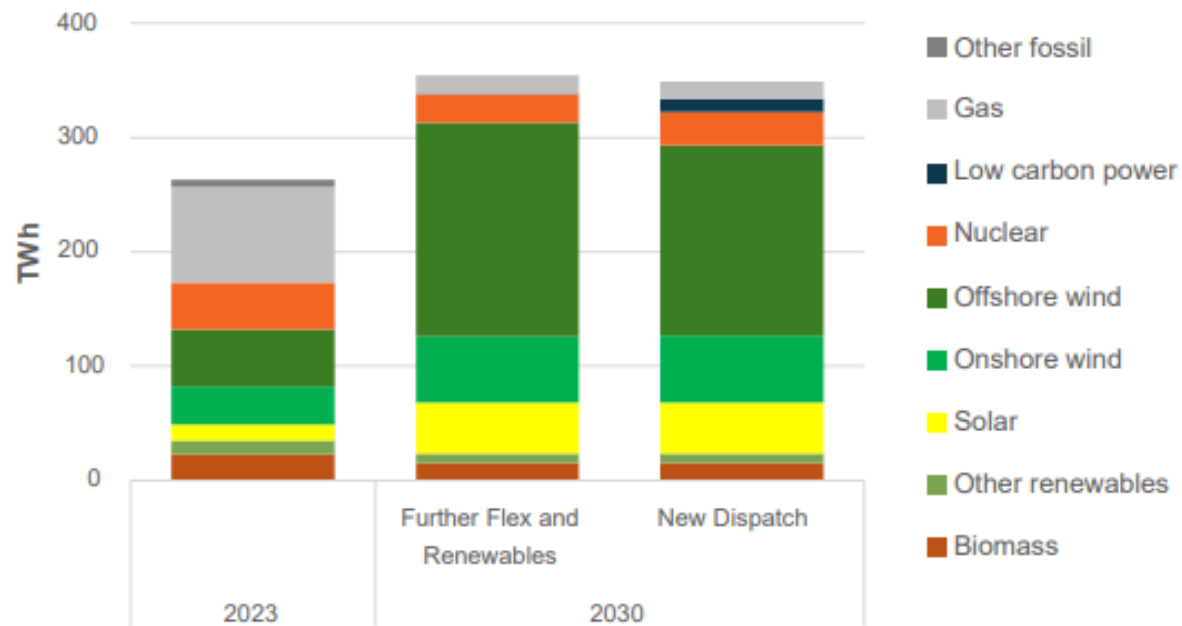
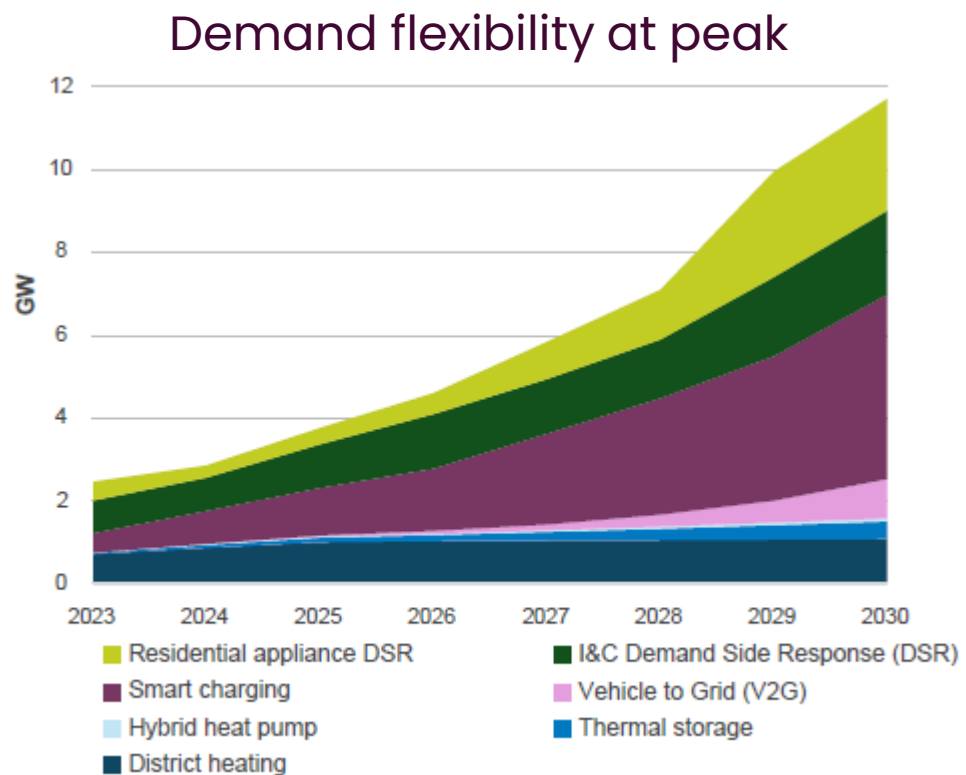


Figure 15: Generation mix for a clean GB power system in 2030

Fuel / technology type (GW)		2023	2030 Further Flex and Renewables	2030 New Dispatch
Variable	Offshore Wind	14.7	50.6	43.1
	Onshore Wind	13.7	27.3	27.3
	Solar	15.1	47.4	47.4
Firm	Nuclear	6.1	3.5	4.1
Dispatchable	Biomass/BECCS	4.3	4.0	3.8
	Gas CCS/Hydrogen	0	0.3	2.7
	Unabated gas	37.4	35.0	35.0
Flexibility	LDES	2.8	7.9	4.6
	Batteries	4.7	27.4	22.6
	Interconnectors	8.4	12.5	12.5
	Demand-side flexibility (excl. storage heaters)	2.5	11.7	10.4
Annual demand (TWh)		258	287	287

How we get to clean power... flexibility



Note: Figures show the DESNZ Clean Power Range, based on the NESO advice.



Long Duration Energy Storage (LDES) up from 3 GW to 4-6GW



Interconnector capacity increases from 9.8 to 12-14GW



5-6x more battery storage, providing short-term flexibility within day



Clean dispatchable generation has an outsized value

How we get to clean power... networks

Delivering the network already planned for 2030 will allow GB to meet Clean Power.

However, success **requires double** the level of onshore and offshore network build seen in the last 10 years, in the next five. TOs have highlighted concerns around deliverability.

Figure 11: Breakdown of the wider required transmission works

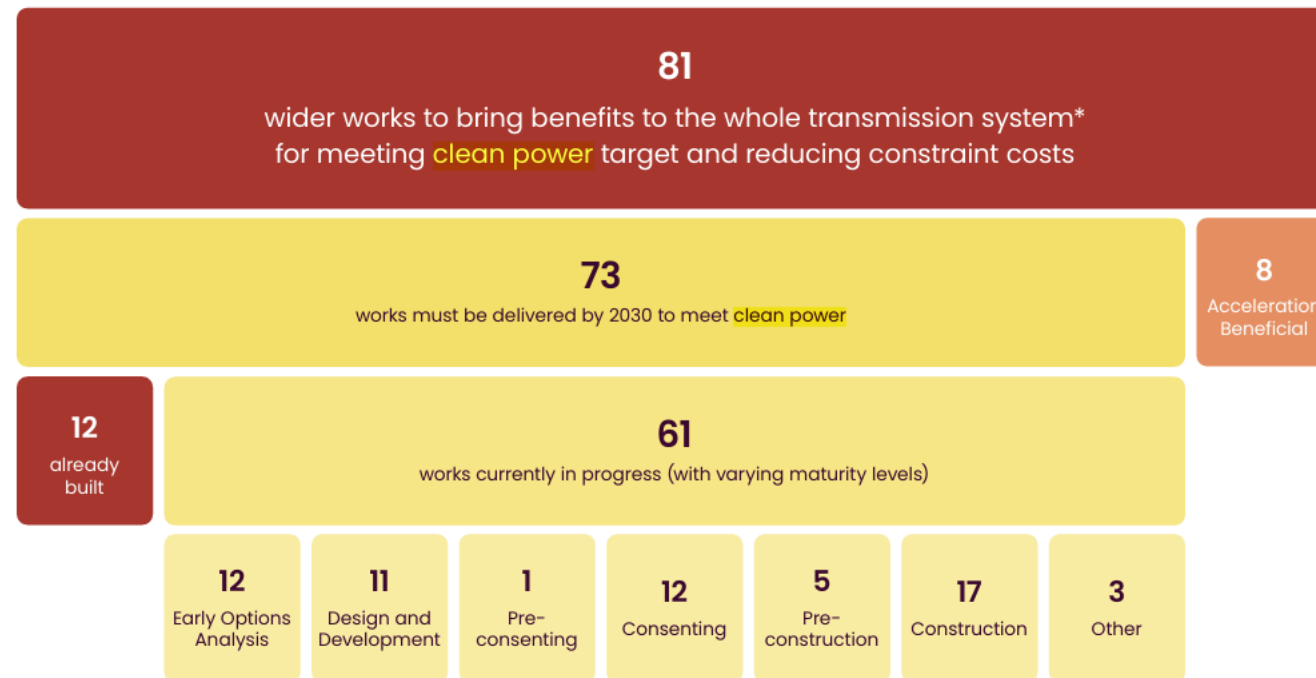
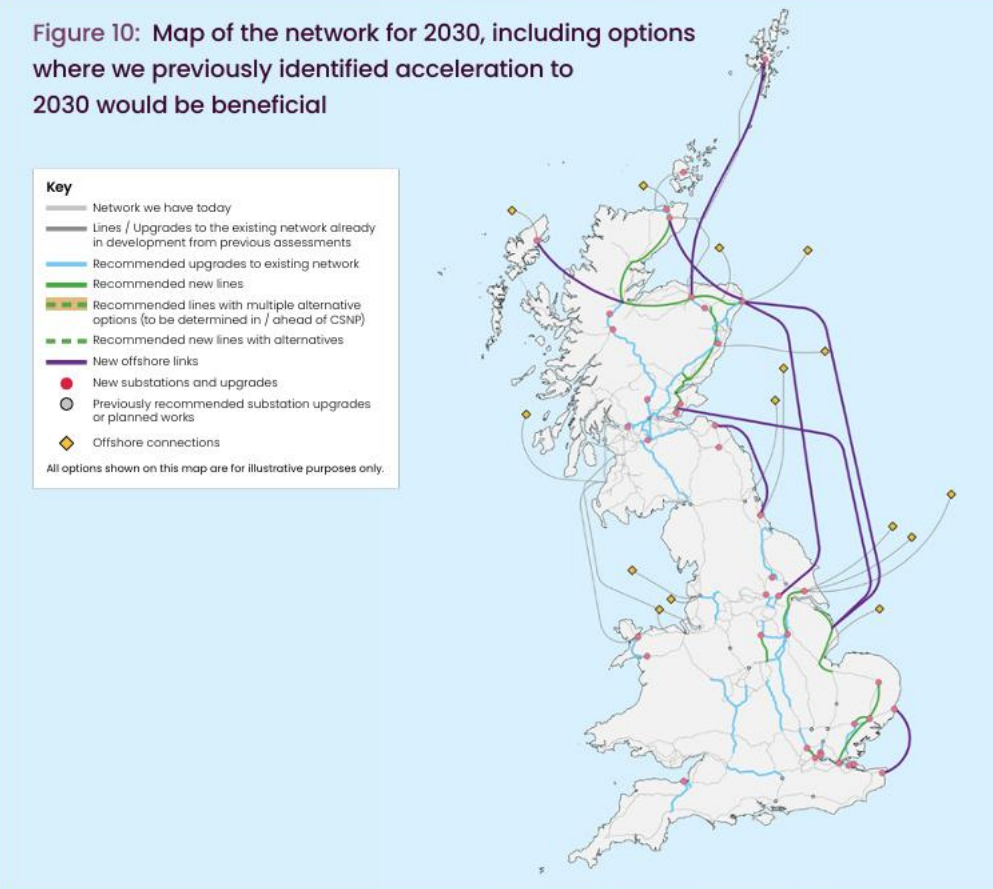


Figure 10: Map of the network for 2030, including options where we previously identified acceleration to 2030 would be beneficial



*Only includes works for wider transmission benefit and does not include works such as connection enabling works, assets needed for operability

*These are wider transmission network reinforcements – they may not include all works for example – works driven by connection enabling works, operability, etc.

(Updated as of March 2026)

64% low-carbon today; ≥95% clean by 2030

What the 2026 refresh changes

The June 2026 tCSNP2 Refresh re-tests transmission need using updated policy, FES and connections evidence. It does not set a new deployment forecast; Beyond 2030 still anchors the mid-2030s network case around 86 GW of offshore wind.

Where the system is — and the capacity pathway to 2030

	Baseline	2030 pathway	Change / signal
Generation share	63.8% low-carbon*	≥95% clean	Unabated fossil <5%
Offshore wind	14.7 GW (2023)	43–50 GW	86 GW network-enabled by 2035
Onshore wind	13.7 GW (2023)	27–29 GW	~2× capacity
Solar	15.1 GW (2023)	45–47 GW	~3× capacity
Nuclear	6.1 GW (2023)	3–4 GW	Managed decline as AGRs retire
Batteries	4.7 GW (2023)	23–27 GW	~5× capacity
Long-duration storage	2.8 GW (2023)	4–6 GW	At least ~2× capacity
Interconnectors	8.4 GW (2023)	12–14 GW	~1.5× capacity

* Q1 2026 generation snapshot; technology baselines are 2023 installed capacity. Capacity ranges are policy-aligned, not forecasts. Sources: DESNZ Energy Trends (Jun 2026); NESO Clean Power 2030 / DESNZ Action Plan (Apr 2025); NESO Beyond 2030 (Mar 2024) and Electricity Transmission Update (Jun 2026).

Reinforcement turns clean generation into usable power

3×

potential increase in balancing costs between 2031 and 2035 without reinforcement

>30%

forecast electricity-demand growth by 2035

£12.7bn

2030 constraint cost if the existing network were retained

£2.8–3.6bn

with planned build — around 75% lower onshore constraint cost

1 More clean power connects

Offshore wind and other renewables increasingly locate far from major demand centres.

2 Bottlenecks limit transfer

The system must turn down generation behind constraints and increase output elsewhere.

3 Reinforcement unlocks value

More clean electricity reaches consumers, lowering whole-system cost and supporting growth.

43 projects: staged by maturity and whole-system value

43

network projects
recommended for
development in the 2030s

More than half are needed by
the mid-2030s and are
already at Strategic
Optioneering or later.

Whole-system appraisal: four criteria, considered on equal footing

ECONOMIC & EFFICIENT

Best value for consumers across
the system

DELIVERABLE & OPERABLE

Buildability, supply chain, timing
and integration

ENVIRONMENT

Avoid and minimise sensitive
environmental impacts

COMMUNITIES

Reduce impacts on places
hosting infrastructure

£64bn recommended
transmission
investment by 2030

£89bn recommended
network investment
beyond 2030

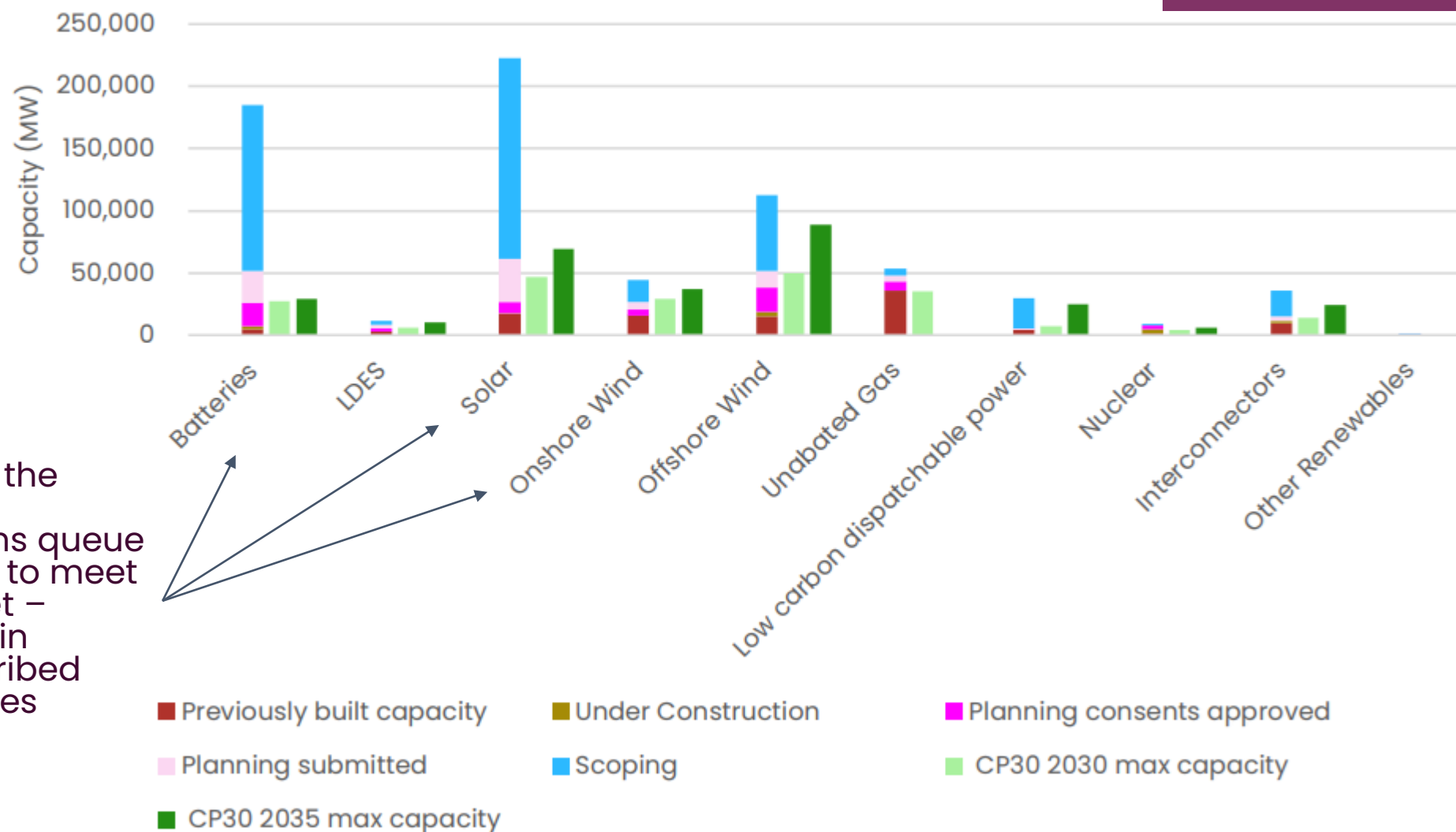
3x more new undersea cable
than new onshore

The design prioritises upgrades to existing infrastructure where possible; new build is recommended only where system requirements demand it.

Connections Reform

Full queue with project planning status

Queue as of December 2024



Reforming the current connections queue is required to meet 2030 target – especially in oversubscribed technologies

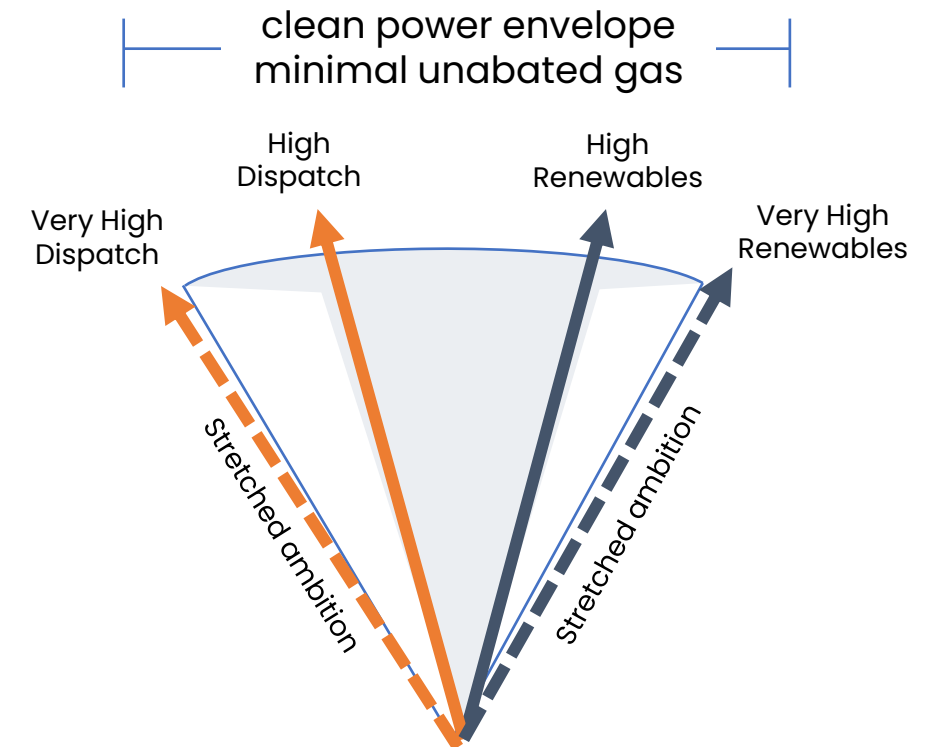
Potential pathways to clean power NESO have examined

Three pathways developed, examining a high renewables roll out, increasing the use of energy flexibility and low carbon dispatchable power.

After feedback on feasibility of our high renewables range and high dispatchable range and the importance of flexibility in all pathways – we have responded by adapting the approach.

Now exploring two primary pathways as well as the upper limits within them:

- **High renewables and flexibility:** Fast development of renewables alongside the highest level of energy storage capacity and consumer engagement in demand flexibility. Minimal new dispatchable low carbon power.
- **High dispatch:** Growth in renewables but the lowest of the pathways. Deployment of low carbon dispatchable power alongside the highest nuclear capacity



Increased demand and system flexibility is embedded into both pathways but more active in the high renewables pathways.

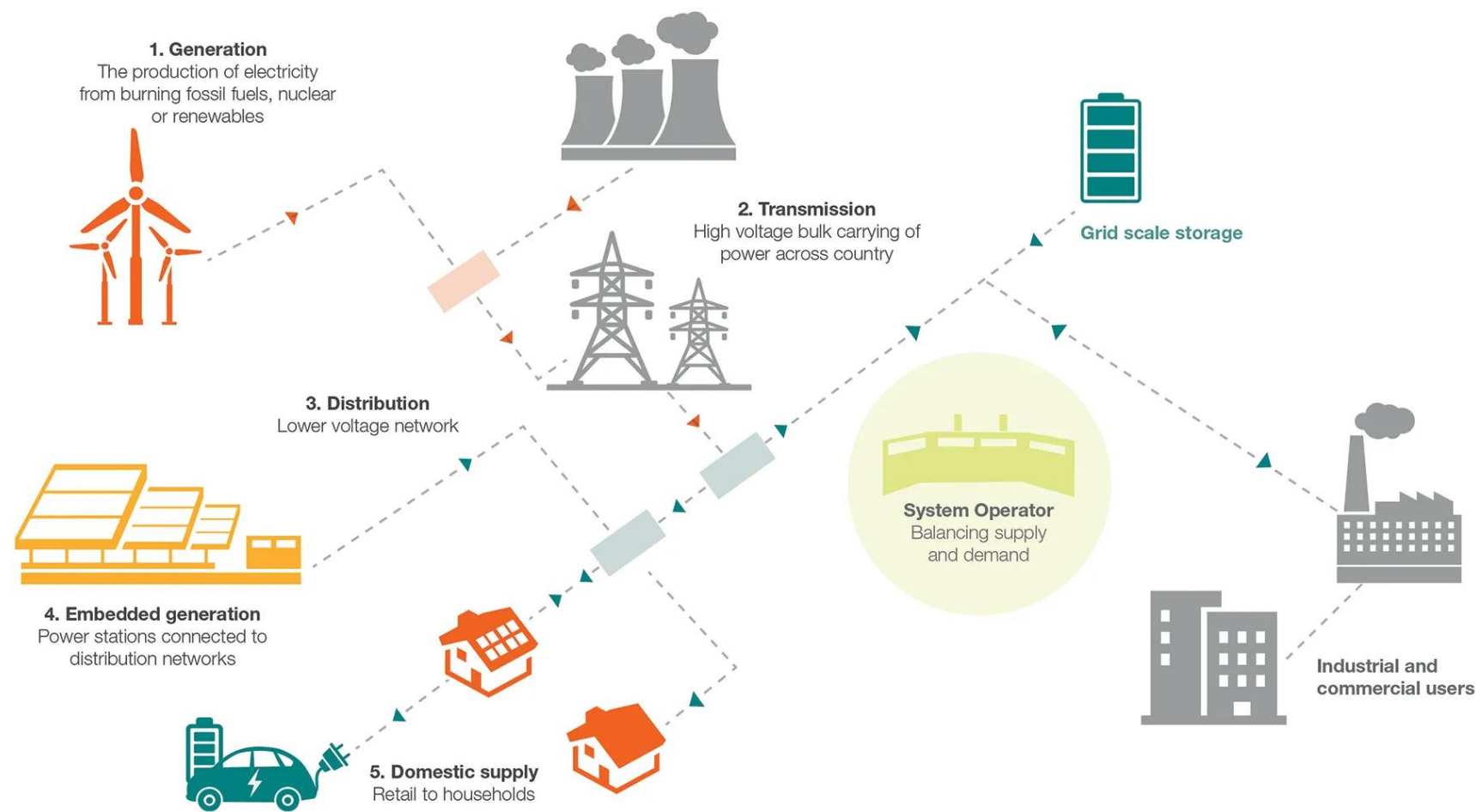
Further sensitivities: batteries, carbon price, nuclear, weather years and increased demand

Overview of GB Electricity (Technical)

- 58 GW peak demand
- 125 GW installed capacity
- 290 TWh annual demand

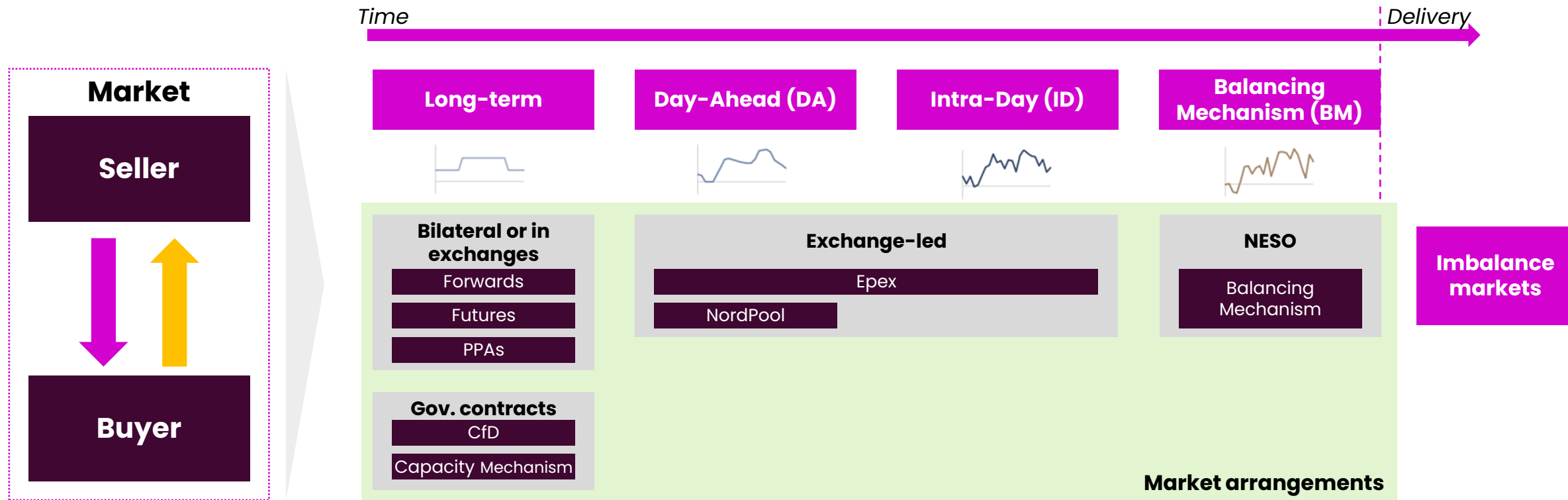
The technical structure of the GB electricity grid is the same as many others in the world:

1. Power stations at all voltage levels generate
2. Batteries and pump hydro store electricity
3. Industrial, commercial and domestic users consume electricity
4. The power networks (transmission and distribution) move electricity around.



The British wholesale electricity market

Markets are the set or framework and regulations that **allow market participants to sell and buy electricity**. They allow participants to trade electricity **along different timeframes**, from years in advance, up to minutes before the delivery of electricity.



CfD: Contracts for Difference
PPA: Power Purchase Agreement

Flexibility Through Markets

Requirements and system needs are identified by the [Operability Strategy Report](#) and by the [Frequency Risk and Control Report](#)

Operational Area	Frequency	Thermal	Voltage	Stability	Restoration
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The Markets Roadmap outlines different markets and products to address these system needs

Market Areas	Response	Reserve	Thermal	Voltage	Stability	Restoration
	Balancing Mechanism (BM)					

Market Products	Dynamic Containment (DC)	Quick Reserve	Megawatt Dispatch	Voltage Pathfinders	Short-term (D-1) Stability Market	Bids & Offers	Electricity System Restoration Events (ESRE)
	Dynamic Moderation (DM)	Slow Reserve	Local Constraint Management (LCM)	Reactive power market	Mid-term (Y-1) Stability Market	Trading	Distributed Restart
	Dynamic Regulation (DR)	Balancing Reserve	Constraint Management Intertrip Service (CMIS)		Long-term (Y-4) Stability Market	Demand Flexibility Service (DFS)	
	Mandatory Frequency Response	STOR	Constraints Collaboration Project				
	Static Firm Frequency Response	Optional Fast Reserve					

KEY

Existing markets/
productsMarkets/products
in development

NESO do not just operate an energy market, they also operate a series of operability/flexibility markets.

Planning a System That Must Also Work in Real Time

**Capacity is necessary.
Physical behaviour is decisive.**

INERTIA + FREQUENCY

Contain disturbances as synchronous generation retires

VOLTAGE

Manage reactive power across changing flows

SYSTEM STRENGTH + STABILITY

Assure converter behaviour and protection

RESILIENCE + RECOVERY

Prepare for extremes and restore safely



Economic · secure · operable · resilient — at the same time.

Build, Optimise or Operate? Managing Constraints Across Timescales



1

Build: Long Term

Strategic reinforcement for structural bottlenecks

2

Optimise: Medium Term

Optimise outages · Procure services · Grid Enhancing Technologies · Flexibility · Network access solutions

3

Operate: Short Term + Real Time

Balancing · Redispatch · Security actions

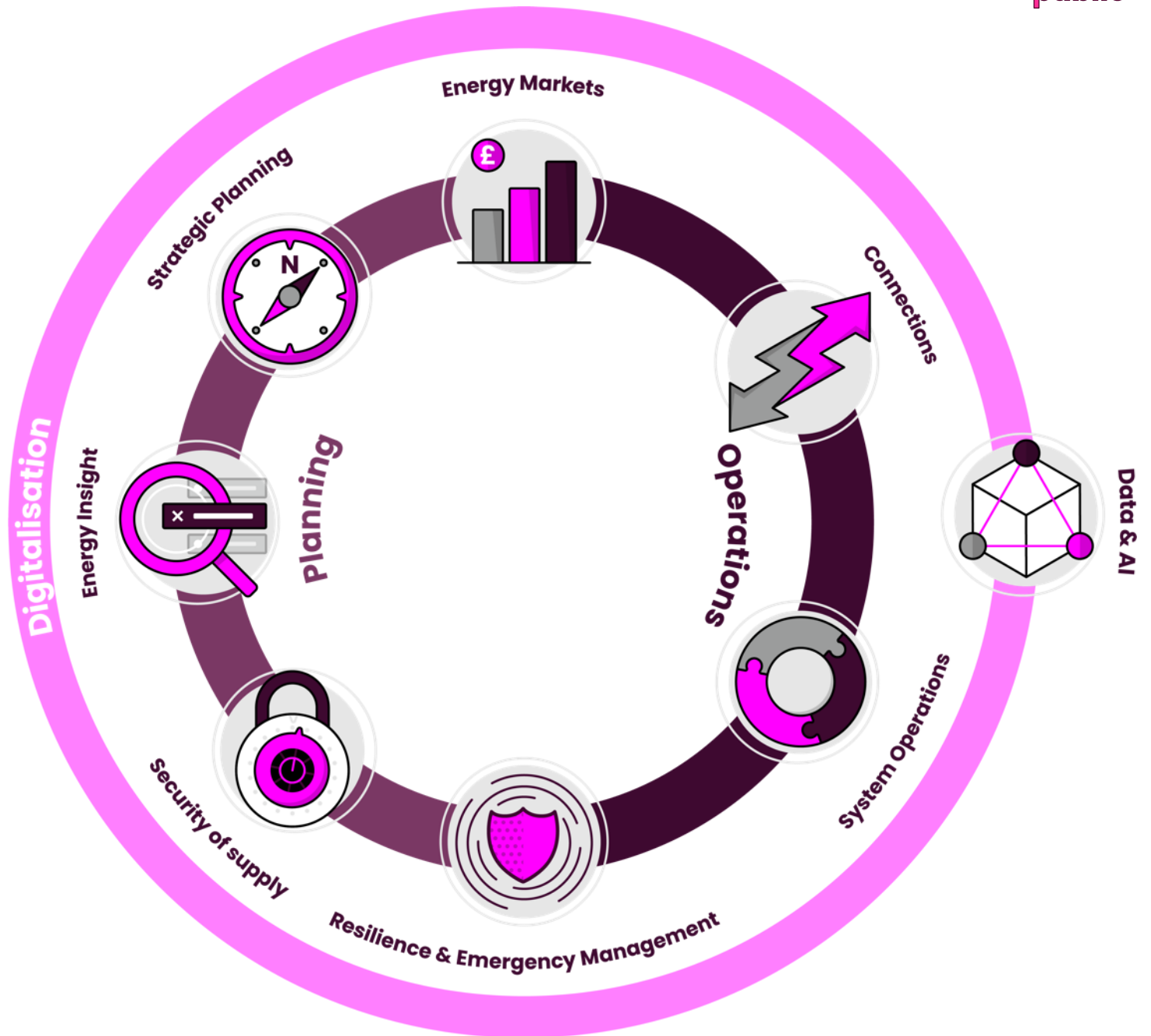
BUILD ENOUGH TO ADDRESS ENDURING BOTTLENECKS — NOT EVERY CONSTRAINT IN EVERY CONDITION

The balance shifts as constraint cost, uncertainty and delivery timing change.

What We Do

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.



Thank you

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