



GB Grid Forming Development

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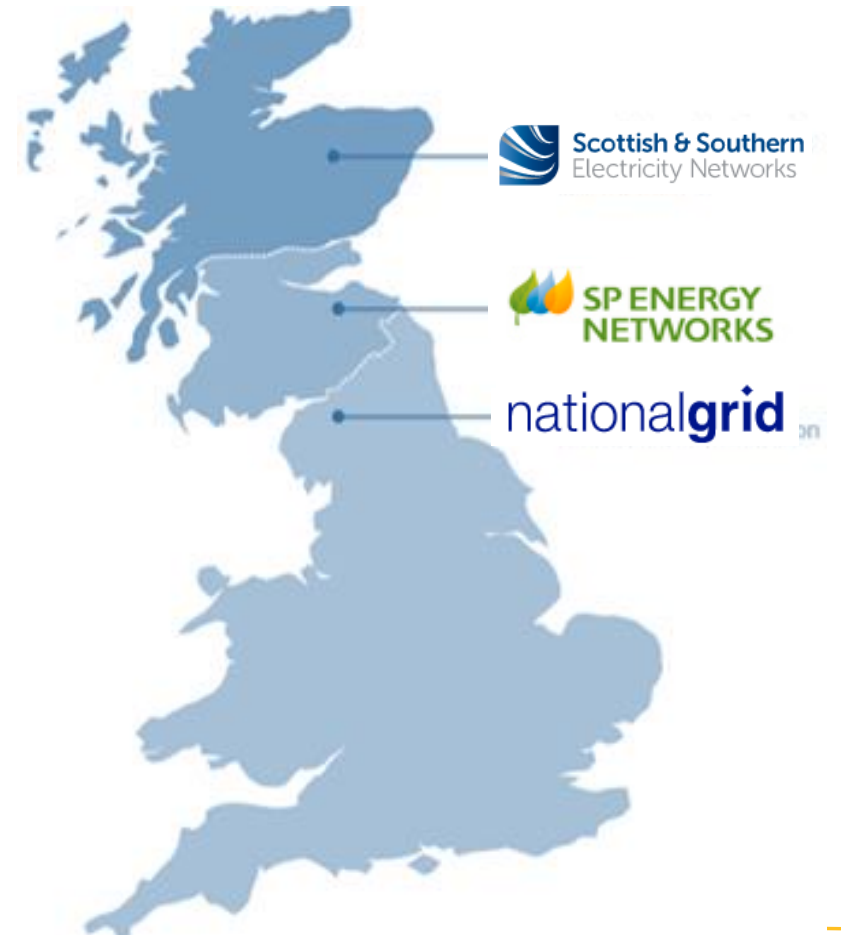
NationalgridESO

National Grid ESO's role

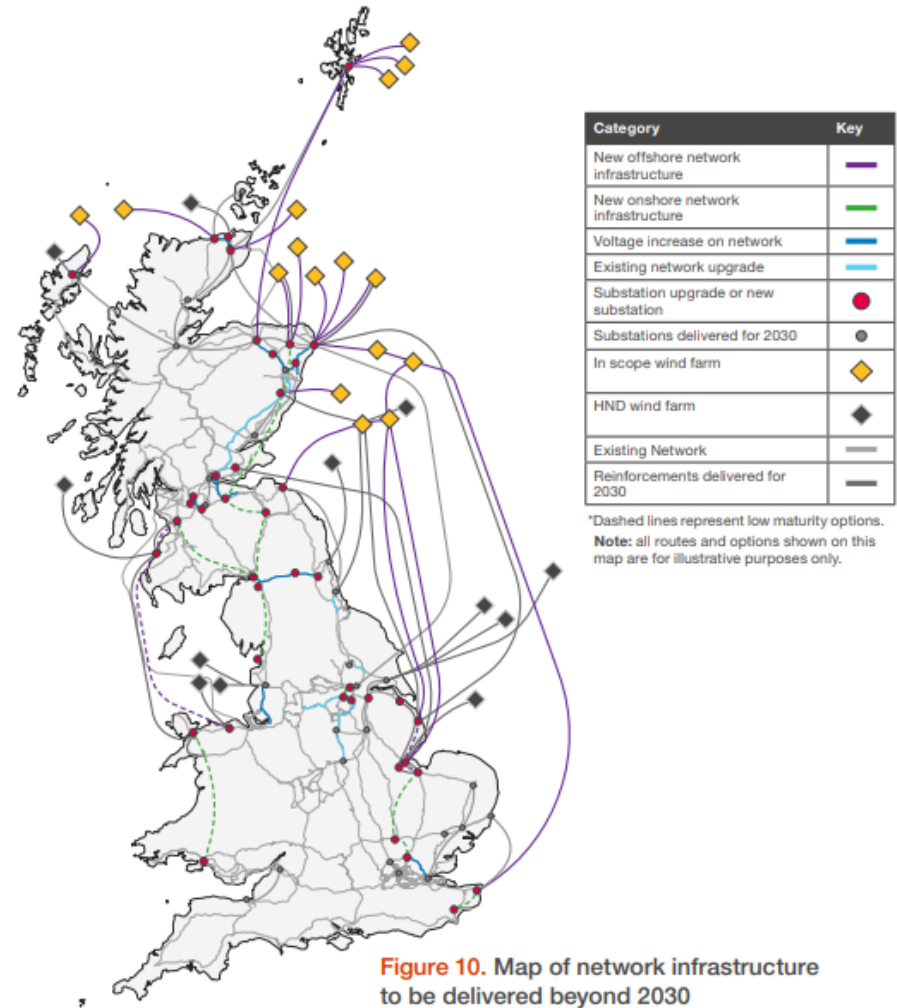
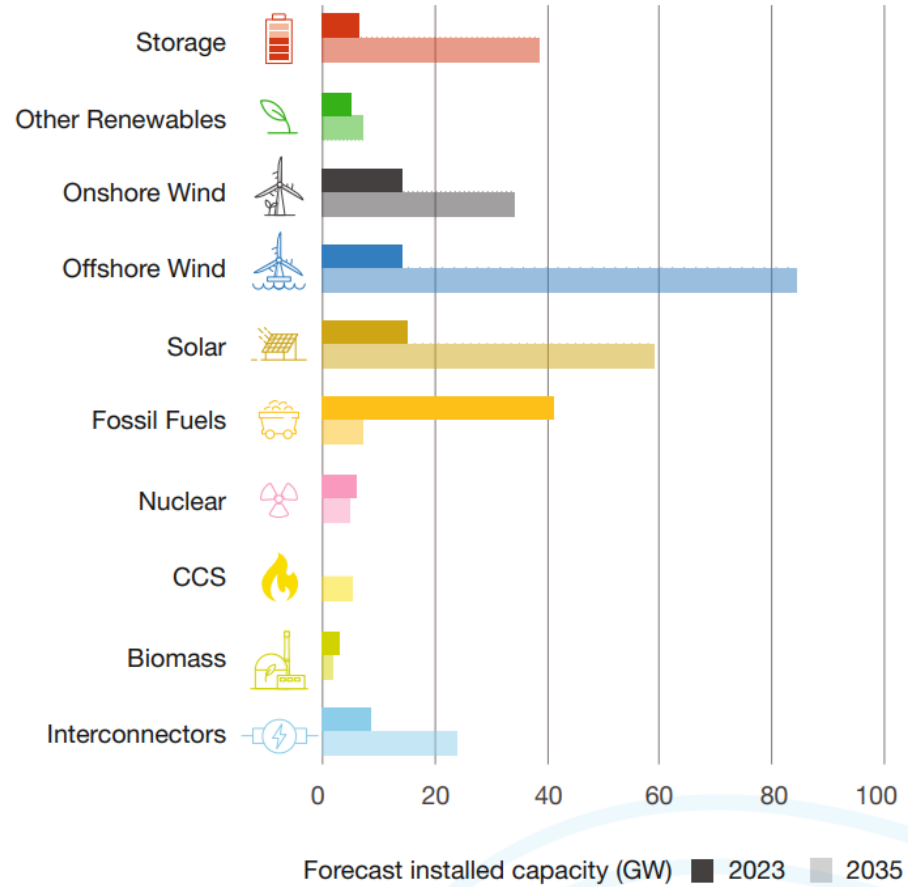
- Operates and balances the system
- Provides electricity network recommendations
- Operational planning
- Connection agreements
- Widens access and promotes competition
- Responsible for GB transmission charging and billing

**NESO (National Energy System Operator)
from summer 2024**

The transmission operators (TOs) own, build and maintain Britain's transmission infrastructure.



How GB system evolves



GB Grid Forming Specification: GC0137

- Provide a high-level overview of Grid Forming and the Transmission System Need
- Develop a **high-level flexible specification** which would be **Non-Mandatory** and provide the necessary framework so the specification can be used in a future market
 - **Technical Specification of Plant Requirements**
 - **Submission of data and models**
 - **Compliance Simulation and Tests**
- Behaves like a synchronous internal voltage Source behind an impedance (similar to a Synchronous Generator)
- The GC0137 as world first GFM Grid Code requirements was approved in 2022 by ofgem

Grid Forming Best Practice Guide

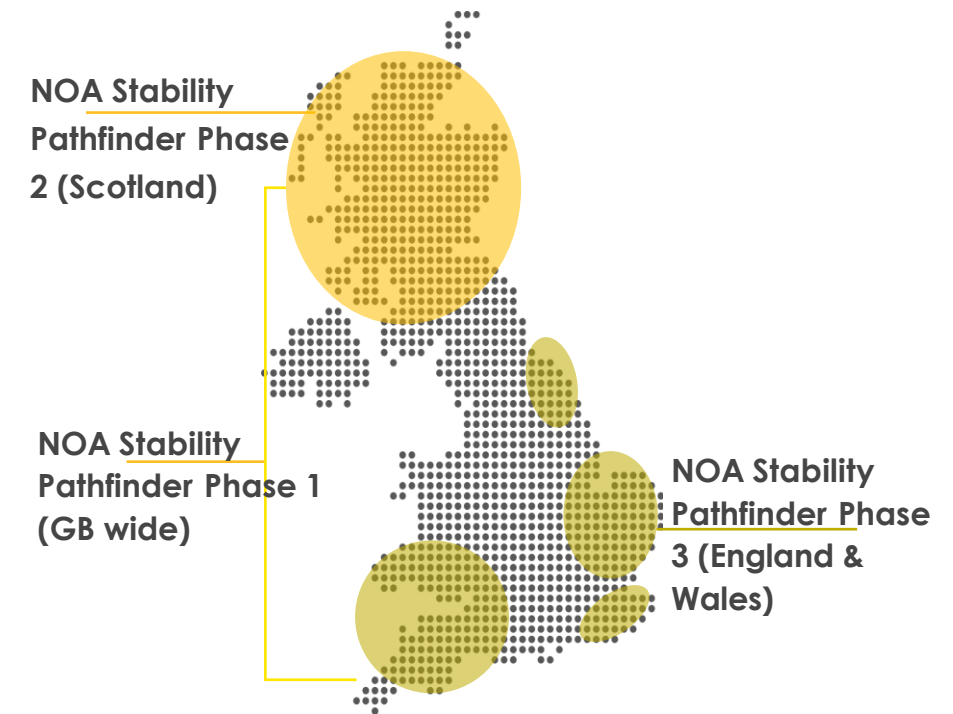
- The GC0137 Minimum Specification is **NOT** as detailed Technical Specification
- The best practice guide is published in 2023

<https://www.nationalgrideso.com/document/278491/download>

- To provide necessary guidance on existing GC0137 Legal Texts as much as possible
- To capture any good practices in GB and wider as well as comprehensive valuable thoughts, suggestions for future development of GB Grid Forming where appropriate.
- To identify any future Grid Code changes that may be required in order to facilitate grid forming applications within GB energy markets.

Stability pathfinder




	Stability Pathfinder Phase 1	Stability Pathfinder Phase 2	Stability Pathfinder Phase 3
Requirement	Inertia and dynamic voltage GB wide	Inertia, SCL and dynamic voltage	Inertia, SCL and dynamic voltage
Status	Tender concluded in Jan 20 with most units now live	Tender concluded in Apr 22. Go-live from Apr 24	Tender period - Commercial window now closed. Go-live expected from 2025
Participating technology	All Synchronous Compensators	5 Synchronous and 5 Grid Forming Converter based	29 Synchronous based
Procurement regions	GB wide	Scotland	England and Wales
Procurement volume	12.5 GW.s of inertia	8.4 GVA of SCL 6 GW.s of inertia	7.5 GVA of SCL 15 GW.s of inertia



First GFM BESS at Blackhillock to be commissioned this summer

Stability Market Design Overview

- To maintain compliance and reduce costs associated with managing stability, we are conducting an innovation project with AFRY to explore designing new markets to procure stability services. More details can be found [here](#).
- Phase 1 concluded in 2022 and recommended that a blend of long and short-term competitive procurement is the optimal approach.
- Phase 2 concluded in 2023 built on Phase 1 and provided more detailed evaluation of eligibility rules, contract structure and procurement strategy.

		Long Term (Y-4)	Mid Term (Y-1)	Short Term (D-1)
 <i>Purpose</i>		<ul style="list-style-type: none"> – Procure capacity in advance (LT), to signal the need for new assets – Allow financing of new build capacity (and enhanced capability, TBD) through LT contracts 	<ul style="list-style-type: none"> – Procure capacity in advance (MT), to adjust LT procurement in case necessary – Allow MT financing of new, incremental and existing capability able to provide stability 	<ul style="list-style-type: none"> – Procure capacity to fulfil residual of total requirements for Stability closer to real time (ST) – Allow remuneration of marginal costs for providing Stability.
 <i>Timeline</i>	<i>Procurement lead time</i>	– Y-4	– Y-1	– D-1
	<i>Contract duration</i>	– 10+ y	– 1 y	– Service windows
 <i>Product</i>	<i>Contract type</i>	– Baseload availability	– Baseload availability	– 4 h (EFA blocks)
	<i>Contract obligations</i>	– e.g. 90% availability	– e.g. 90% availability	– 100% availability

Further Development of GFM

- GC0163: GFM behaves like a synchronous internal voltage Source behind an impedance, virtual impedance is allowed
- Mandating GFM, minimum GFM requirements
- Phase angle jump limits?
- GFM performance when limits are reached: energy limits, current limits
- Grid Forming modelling and compliance Testing: inverter level and plant level
- Frequency domine tools for GFM validation
- Streamline the compliance process: GFM/GFL mode change, Flexible stability service
- Continuous performance monitoring - Inertia and Phase Jump Angle, GFM Vs fast frequency response
- Interaction of GFMs/GFLs