TRANSFORMING ENERGY POLICIES – ADAPTING ENERGY REGULATION

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SYSTEM SECURITY IN THE ERA OF RENEWABLES AND BALANCING

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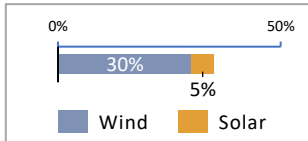
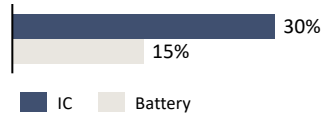
Context in Great Britain

Type of energy market	System Size[1]	% RES in generation mix(2024)	Flex. capacity vs average demand %(2024)
National energy market, self-dispatch	319 TWh		

Dispatch/balancing approach

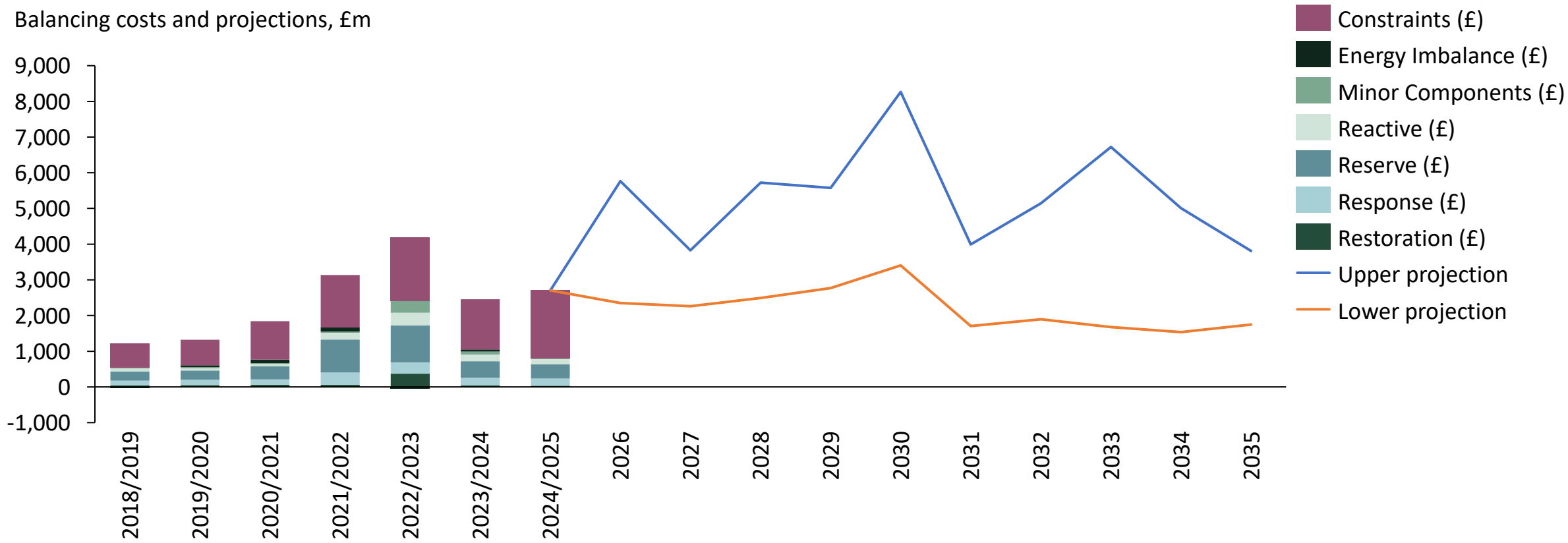
- GB operates a self-dispatch electricity market with a central Balancing Mechanism operated by NESO.
- Participation in the Balancing Mechanism (BM) is voluntary for most generators and demand units, but assets must be BM-registered to offer actions.
- No central unit commitment optimisation, GB does not centrally co-optimise energy and reserves. Commitment decisions remain with market participants.
- The BM operates from Gate Closure through to real time.
- Ancillary / System Services procured separately from energy, system services are unbundled from the energy market and procured via: Day-ahead auctions, Near-real-time / seasonal tenders, and 10-year pathfinders for reactive power and stability
  - Key services include dynamic & Static Containment, Dynamic Regulation Reserve (e.g. TWFR, FFR legacy), Inertia and stability services

Key oper. challenges

- Relatively high balancing costs due to:
  - Transmission grid congestion
  - Increasing stability constraints due to high renewable penetration
  - Frequency stability and oscillations (high % inverter-based generation, no AC interconnection)
  - Demand-side concentration risks creating local network stress

Context in Great Britain: Balancing costs

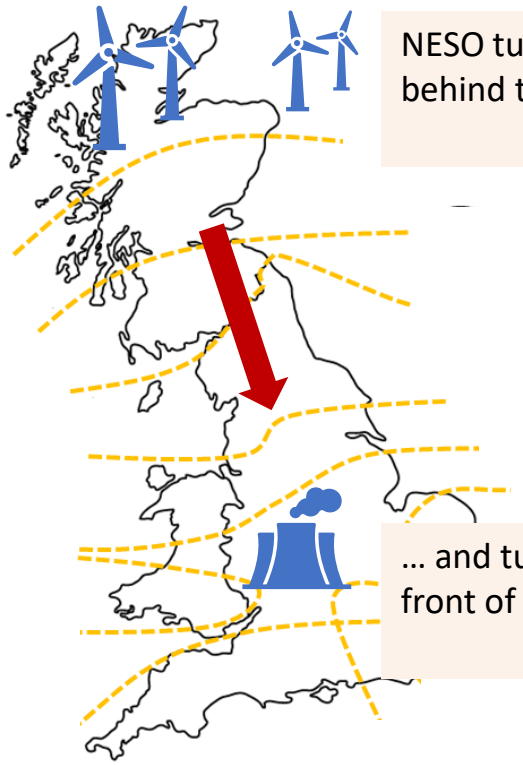
Balancing costs represent NESO's spend to keep the system stable by balancing the system in real-time. Costs have been rising year-on-year and are expected to continue to increase. Constraint costs is the largest contributor.



Reference: 2025 Annual Balancing Markets Report NESO, March 2025
Future projections represent the highest and lowest balancing cost projection of NESO's scenarios: Holistic Transition, Electric Engagement, Hydrogen Evolution, and Counterfactual

Context in Great Britain: Transmission network constraints

- Transmission network constraints have become the main operational challenge in GB
- To manage constraints, NESO will typically need to pay generators to stop generating electricity in constrained areas, while paying other generators to come online in areas that are free of constraints
- Key transmission constraints are from north to south, with high wind renewable capacity located in Scotland and the North Sea, and most of the demand centres in the South of England
- NESO needs to manage a significant volume of redispatch actions on days with high renewable generation, with limited opportunities to take early scheduling actions. Trading on Southern interconnectors is available to NESO ahead of time to help alleviate constraints, but most NESO actions are taken in balancing timeframes



NESO turns down generators behind the constraint area…

… and turns up assets in front of the constraint area

Reference: 2025 Annual Balancing Markets Report NESO, March 2025
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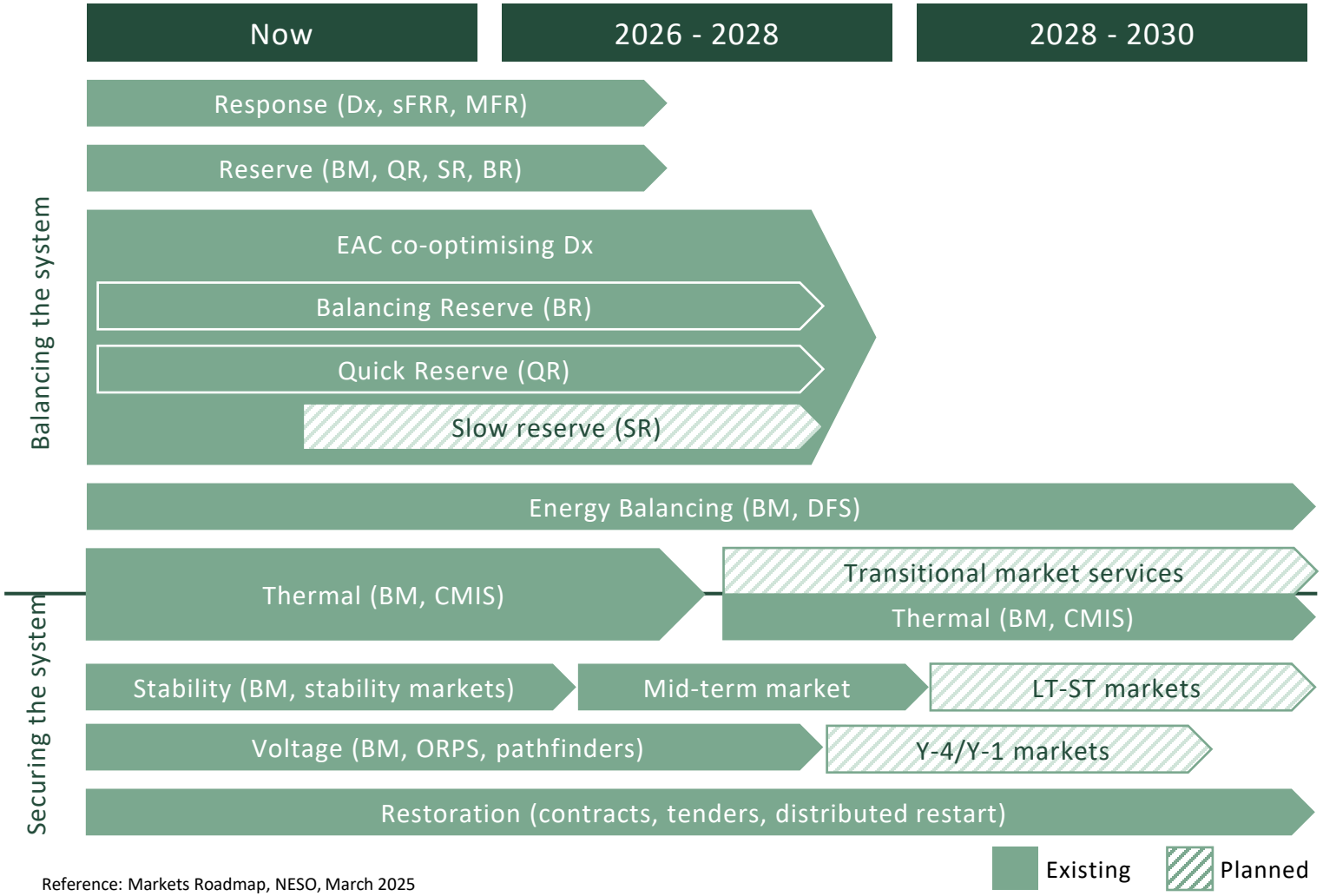
GB: New set of system services

Forward-looking view of NESO's markets



Reference: Markets Roadmap, NESO, March 2025

Strategic questions for market development

What reforms may be made to scheduling and dispatch arrangements?

How will locational operational signals be sent (wholesale or otherwise)?

How can we improve the coordination of procurement across these markets, including enabling stacking where additional value can be unlocked?

GB: REMA MARKET REFORMS

REMA considered a suite of options, narrowed down to national pricing reform, and zonal pricing reform

Wholesale market pricing	National pricing	Zonal pricing	
Balancing and dispatch	Self-dispatch with balancing reforms	Self-dispatch	Centralised dispatch
Alternative locational investment signals	TNUoS reform	Access rights reform for storage	Access rights reform for generators
Alternative locational operational signals	Optimising the use of cross-border interconnectors	Expanding measures for constraint management	Wider operability measures
Settlement period	Current period (30 minutes)	Shorter period	

National pricing reform | Zonal pricing reform | Option no longer considered | Considered elsewhere

Reformed national pricing is currently the preferred option going forward. Strategic special energy plans will be a key indicator

Reformed national pricing	
Siting and investment levers	Investments happen at right times and places across the system
Network constraint reforms	Further reduce cost of network
Market operability reforms	Improving how markets operate, so NESO can run low-cost system

Strategic special energy plans will define how much generation, from different technologies, is needed when and where across the power system.

This will be split by different zones in the electricity market, reflecting system boundary points.

These plans are a key component of reformed national pricing, and will be driven through:

- Planning reform
- Seabed leasing
- Network build
- Connections reform
- Locational charging reform
- Investment support mechanisms

Ref: Review of Electricity Market Arrangements, Autumn update

VOLTA: FUTURE OF SYSTEM OPERATION

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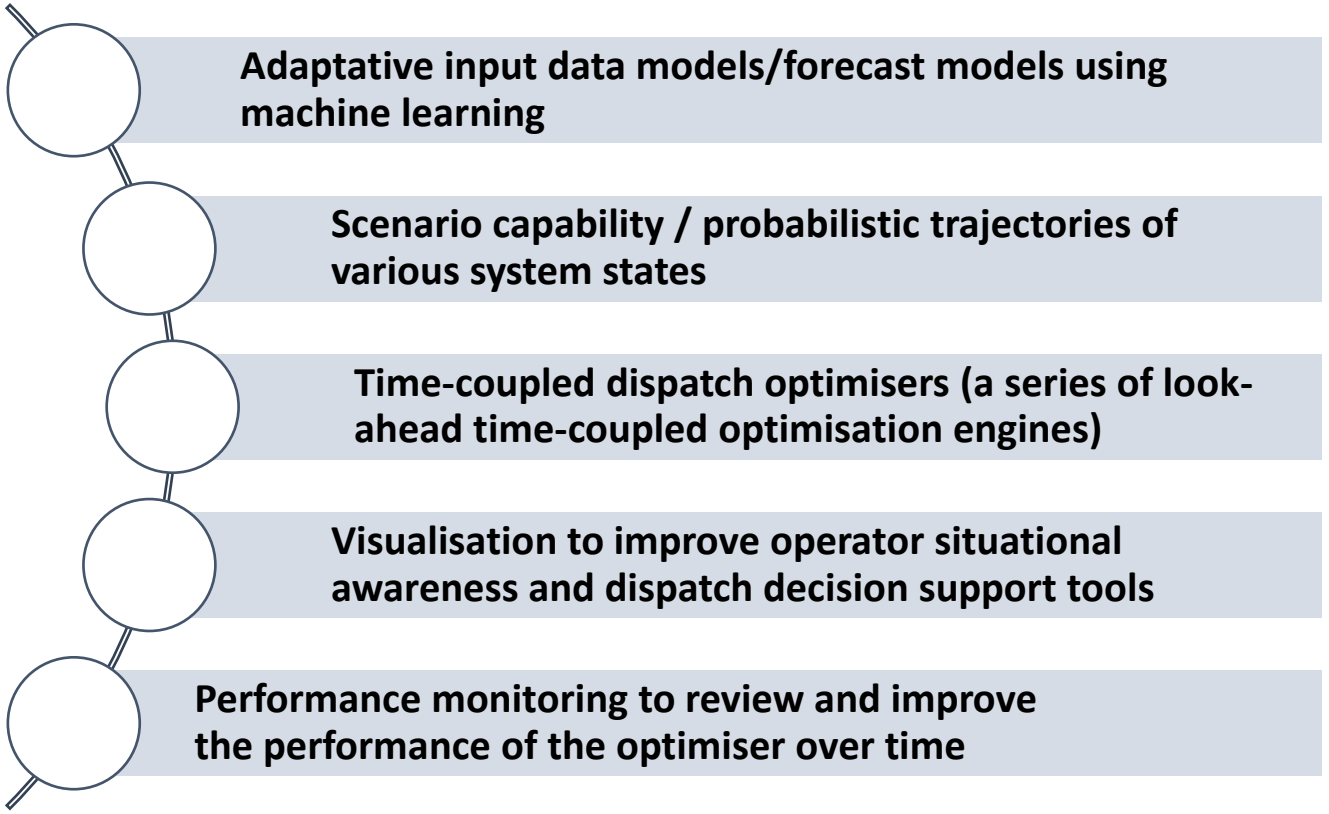
- NESO is undertaking the Volta Programme to develop and implement a new optimiser dispatch system that is fit for purpose for the energy system of the future

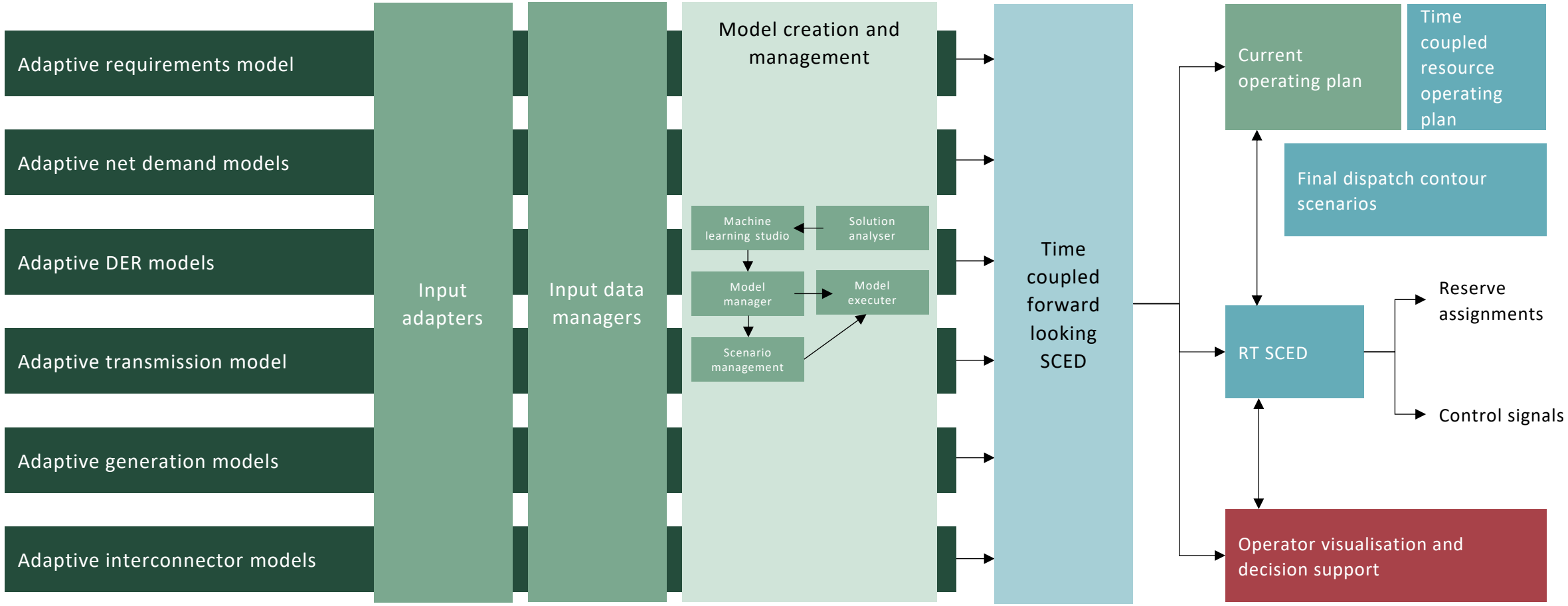
- The Volta Programme seeks to use the new techniques of **machine learning, artificial intelligence advanced optimisation** to enhance the tools within the control room. This will contribute to improve forecasting and to better optimise dispatch decisions

KEY ASPECTS OF THE VOLTA VISION



VOLTA: FUTURE OF SYSTEM OPERATION

Architecture mapping was produced by Google Tapestry as part of the Advanced Dispatch Optimisation project, further developed by IBM



THANK YOU FOR YOUR ATTENTION!

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