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A FORK IN THE ROAD TOWARDS DECARBONISING THE POWER SECTOR: A CONTINUED EXPANSION OF CENTRAL PLANNING VS. EMBRACING COMPETITION

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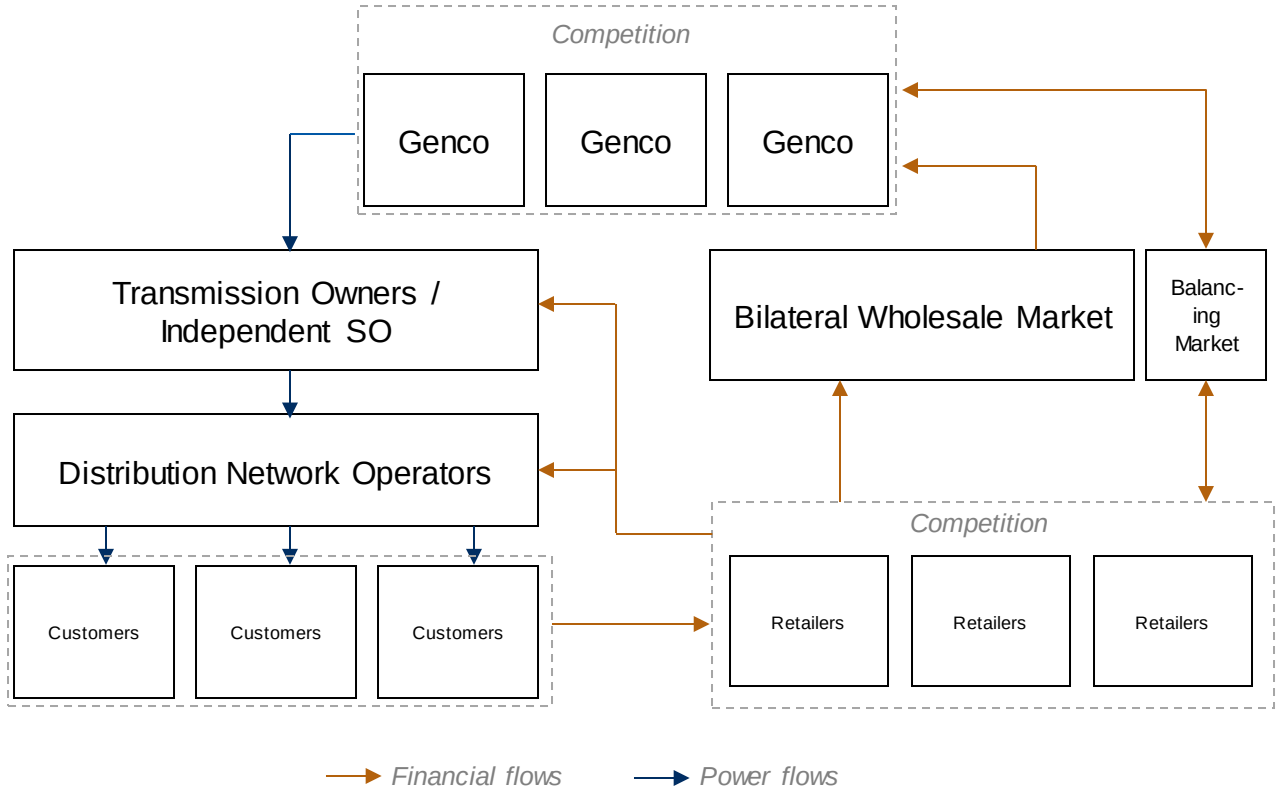
Overview

- Foundations of liberalised electricity markets that enable competition to drive efficient despatch and investment
- Changes in the power system undermining these foundations, and necessitating centrally planned interventions
- Possible directions of travel for the future organisation of the power sector: expansion of central planning vs. reform of long-term procurement practices to enable competition

The current market design was established to promote efficient despatch and investment, by harnessing competition

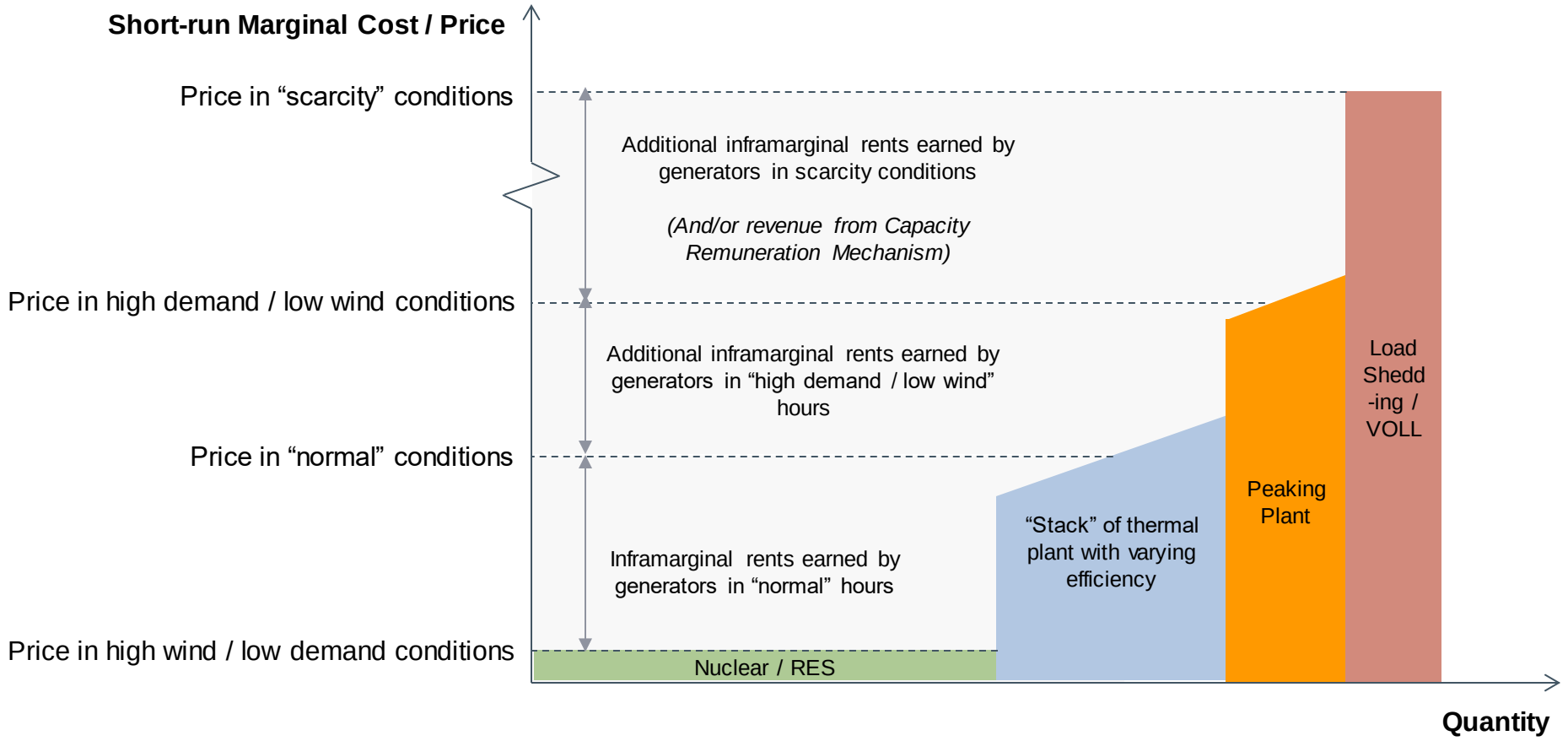
- Current electricity market structures aim to promote efficiency and innovation through competition and customer choice by:
  - Establishing trading platforms and tradeable products reflecting reasonably accurately system needs
  - Separating natural monopoly segments of the industry (T&D) from potentially competitive ones
  - In many jurisdictions, privatizing former ministerial and municipal providers
- Stable institutions and a regulatory commitment to competitive markets (except in natural monopoly segments of the value chain) succeeded in attracting capital

Current, typical power market design in Europe

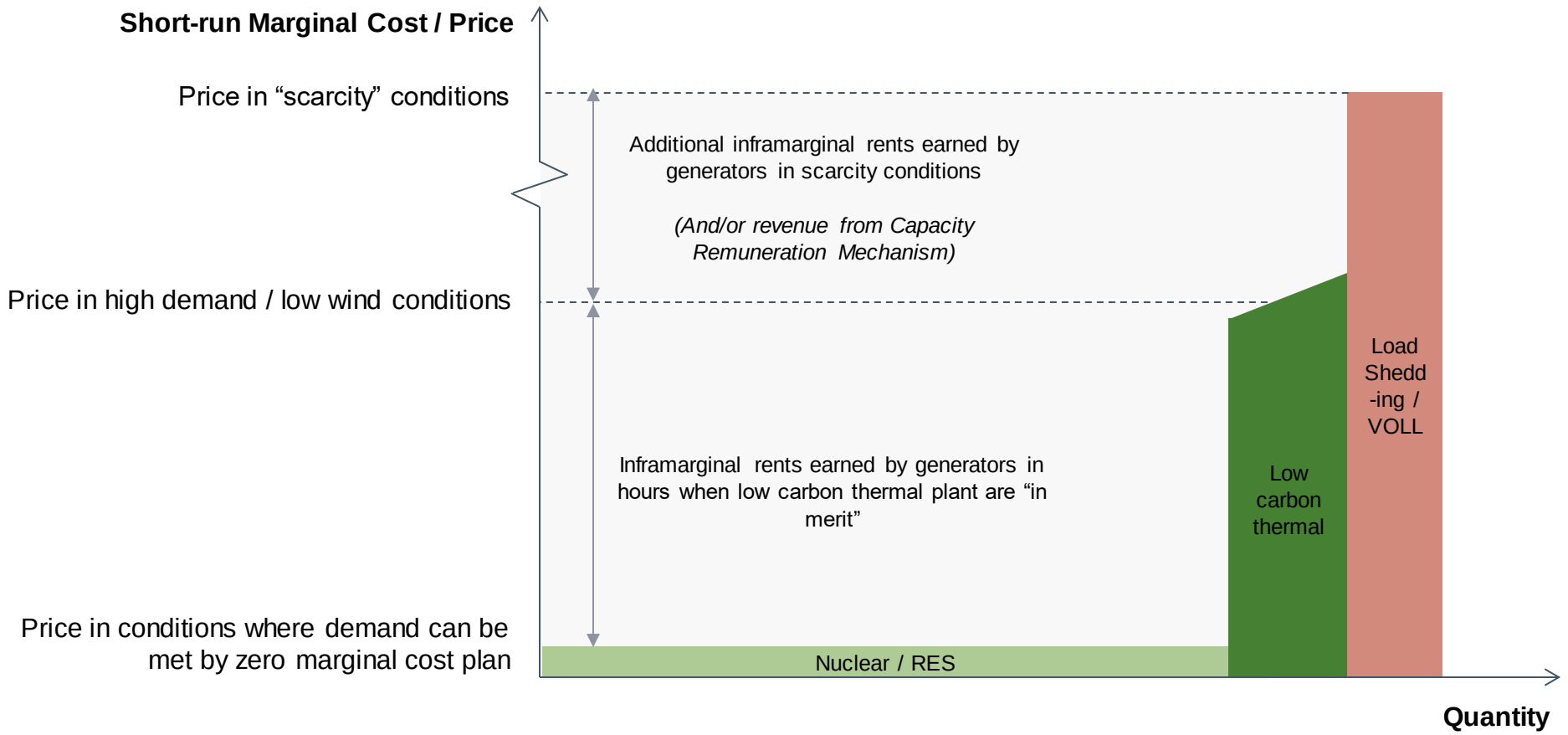


The market design creates a mechanism for attracting generation investment, in response to opportunities to profit from energy prices above marginal production costs

- Under this standard market design, the market clears at the system marginal price, allowing investment to come into the market and earn "inframarginal rents" and profit from deploying new generation

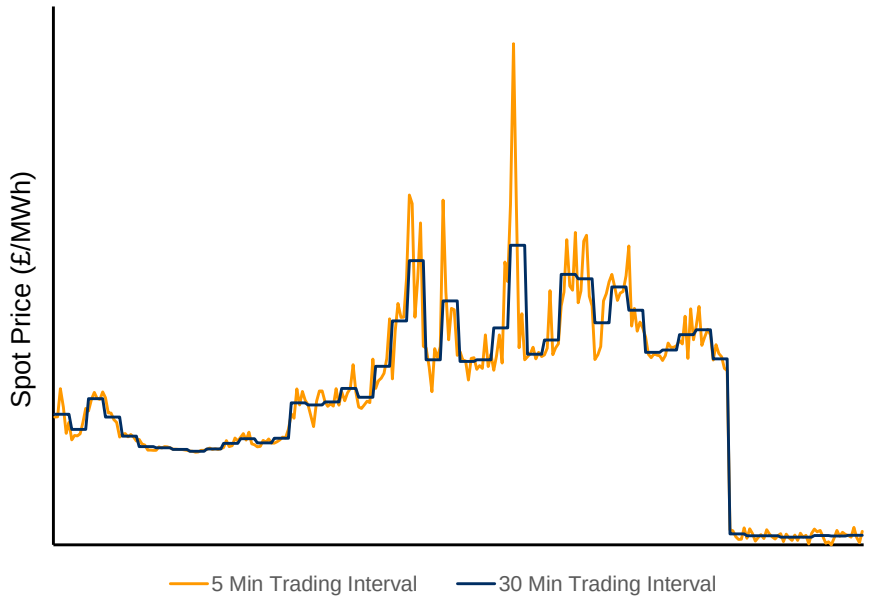


Conceptually, this market design still works in a wholly renewable system, but….

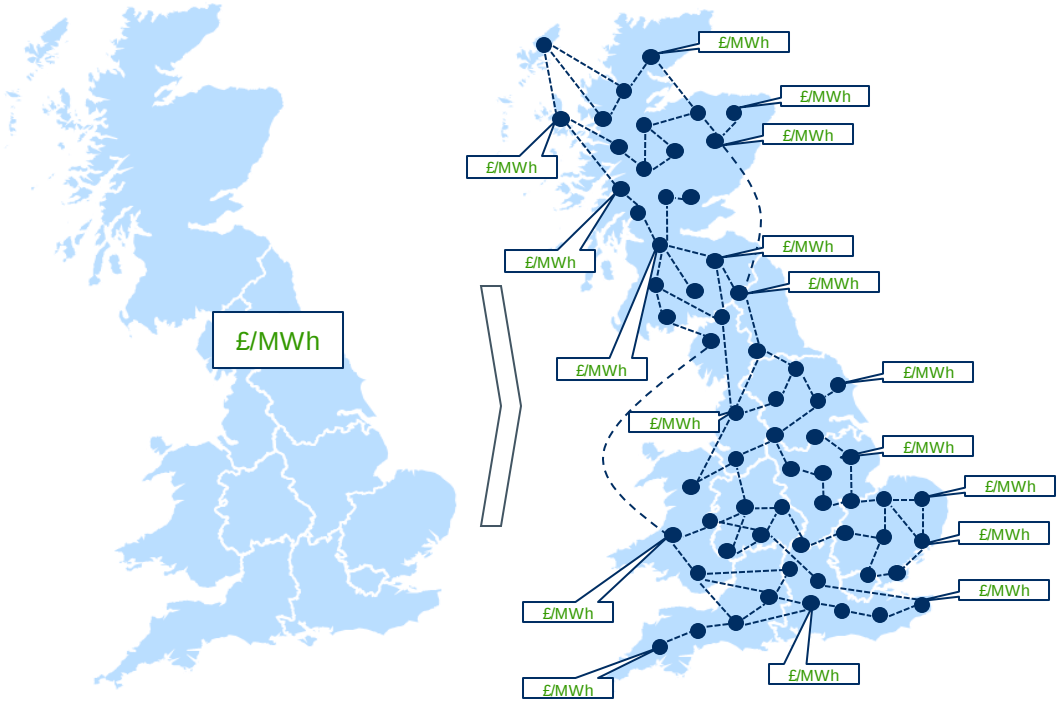


… reforms are needed to the core **product definitions** used in the wholesale market, e.g. locational pricing and shorter trading intervals

Shorter trading intervals increase the accuracy with which the market can signal changes in supply-demand fundamentals over time



Nodal or zonal energy pricing can signal how supply-demand fundamentals differ across different geographic areas



None of these reforms address comprehensively the competitive market's inability to encourage efficient ***investment*** to achieve net zero

Original Vision of Competitive Electricity Markets	Current Reality: Investment Requires Long-term, State-backed Contracts
• Private sector investors choose timing, location and type of investment, considering their likely profitability in despatch time horizons	• A variety of factors mean the state **has to issue long-term contracts** to attract long-lived generation investment: – Market signals of decarbonisation and innovation benefits of low carbon technologies are "**incomplete markets**", preventing efficient investment – **State interventions in markets to address this problem** undermine investors' ability to commit capital to long-lived generation investments – The **state or SO selects which investments are needed**, using market mechanisms to run very limited tenders for project-specific contracts

Reforms to the product design in investment contracts will also be needed to attract the investment needed to meet customers' energy requirements and decarbonise efficiently

Key Features of Long-term Investment Contracts Currently in Use in Europe

Technology Choice	• The specification of tenders varies, e.g. between: – Tendering the right to develop a project at a pre-specified / pre-prepared site; to – Competition between developers of comparable projects in different locations.
Counterparty	• Offtakers are typically state bodies or large, creditworthy corporates
Contract Term	• The contract term is life-of-plant, or a sufficient time to repay long-term debt finance
Pricing	• Prices are set at the estimated levelized (i.e. per MWh) cost of the plant, or a per MWh price emerging from a tender • Developers are substantially insulated from power price risk, e.g. via a CfD mechanism • Some risks of regulatory change are born by the offtaker
Volume	• Contracts are typically for specific projects, with contract volume equal to metered generation
Role of Competition	• Contracts are awarded following competitive tenders between groups of similar projects • Some contracts are awarded without any meaningful competitive tenders

Limitations of Current Approach

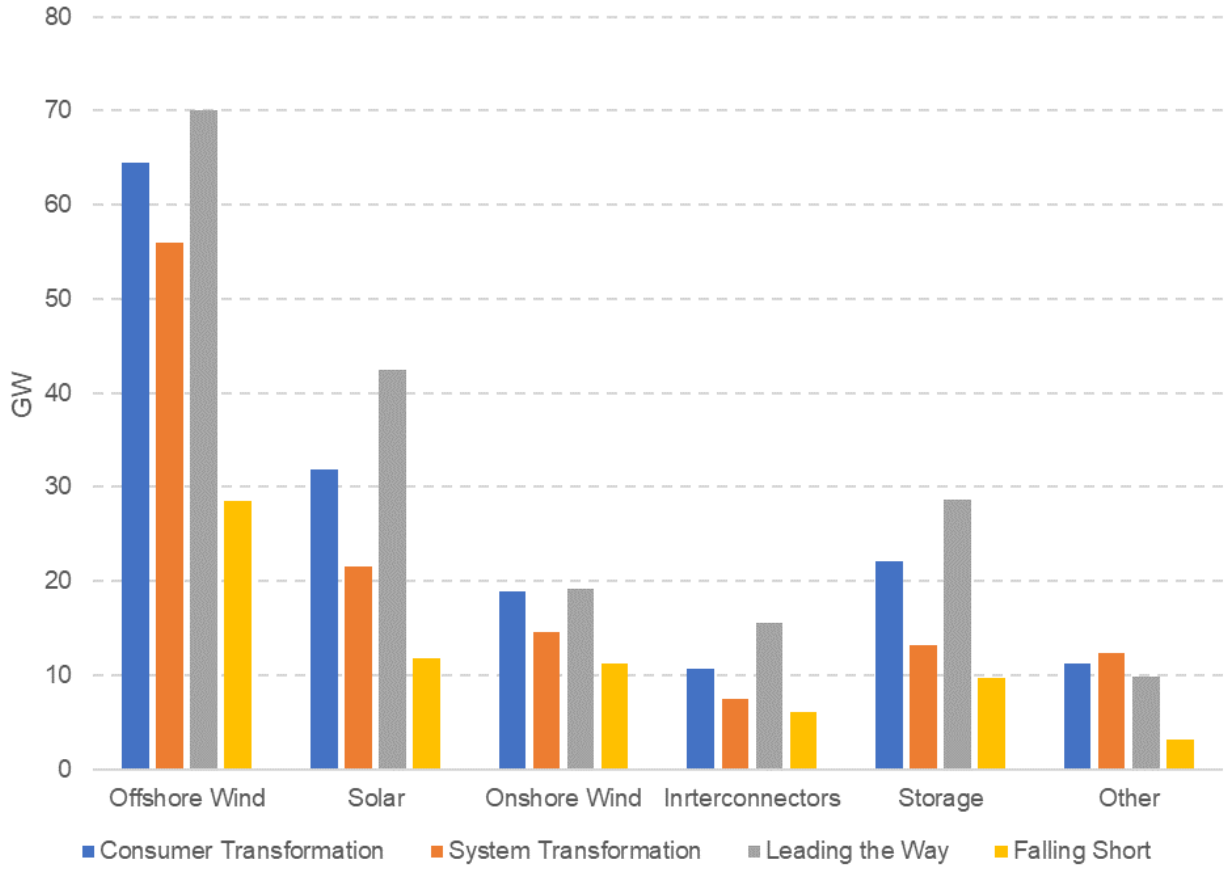
- Competition promotes cost minimisation and innovation in *project delivery*, not meeting customers' long-term, low carbon energy needs
- Generators have little incentive to respond to wholesale prices, which can distort markets, or to match customers' demand requirements
- As the wholesale reference price in CFDs becomes a poor reflection of system needs, it may undermine the long-term credibility of the contracts

Without change, vast amounts of power sector investment will need to be centrally planned

- There is an immediate need for significant investment to achieve net zero
- However, under the current approach to long-term power procurement:
  - A central planner needs to identify the "correct" energy mix;
  - Bidders for long-term contracts have limited incentive or ability to respond to market signals when investing; and
  - The contracts they receive are increasingly detached from the needs of the system and the customer

The current approach to long-term procurement is disjointed, and likely unsustainable

NG ESO: Total Change in Installed Capacity (GW) 2023 vs. 2035 by 2023 FES Scenario



Source: NERA analysis of National Grid ESO 2023 FES data.

Two possible directions of travel for long-term contract design

Possible Directions for Future Market Reform to Encourage Efficient Investment

Option 1: Allowing Competition to Shape the Path to Net Zero

Create a **new form of long-term hedging contract**, enabling competition to determine the best way of meeting customers' long-term demand for zero carbon energy

Option 2: Accept and Formalise the Role of Central Planning

Formalise the role of central planning of generation and storage resources needed to achieve net zero and meet customers' requirements

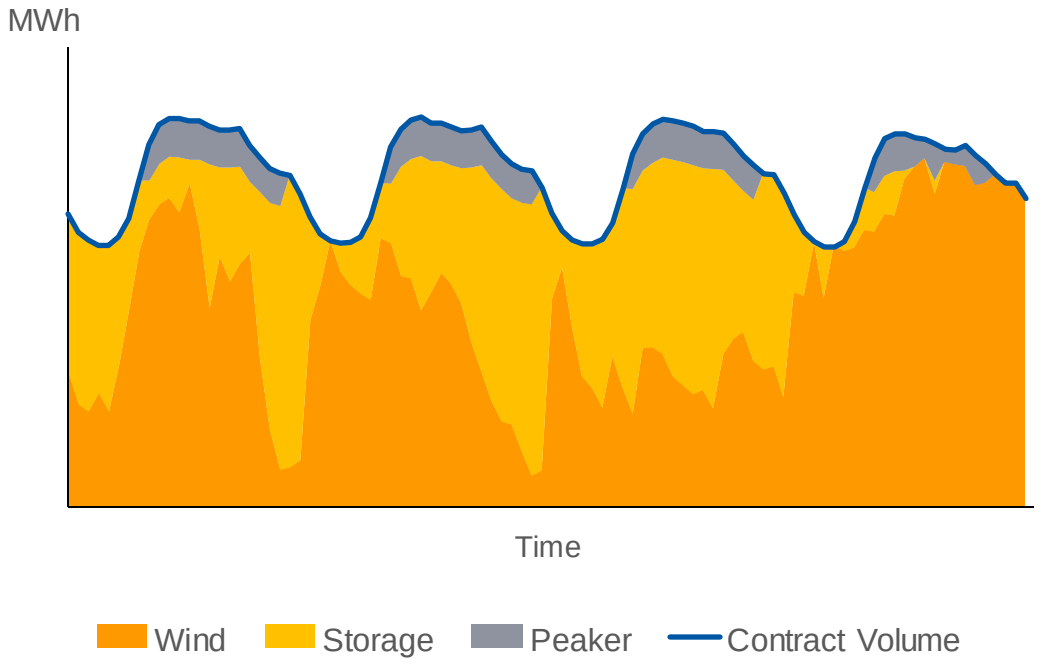
These options differ in the contract design used to provide long-term, state-backed commitment to support investment in low carbon technologies

Option 1 provides long-term commitment to support investment, but allows the market to decide how to meet customers' needs with the desired carbon intensity

Option 1 Places Generation and Storage Investment Choices in the Competitive Domain of the Market

Key Features of this Option:

- In contrast to the status quo, developers would compete to construct a portfolio of resources to match the contract shape required by the customer
- Contracts would be technology-neutral, and for MWh of supply structured to match the load profile of end-users
  - e.g. a CFD with a volume equal to a defined load shape, and a MRP equal to the wholesale price
- As now, the counterparty would need to be a creditworthy customer or a state-backed entity operating on behalf of the customer base
- Mechanisms to ensure delivery of key outputs would need to be designed:
  - Certification to demonstrate the contracted portfolio meets the required level of decarbonisation
  - Financial security / collateral to ensure credibility of suppliers

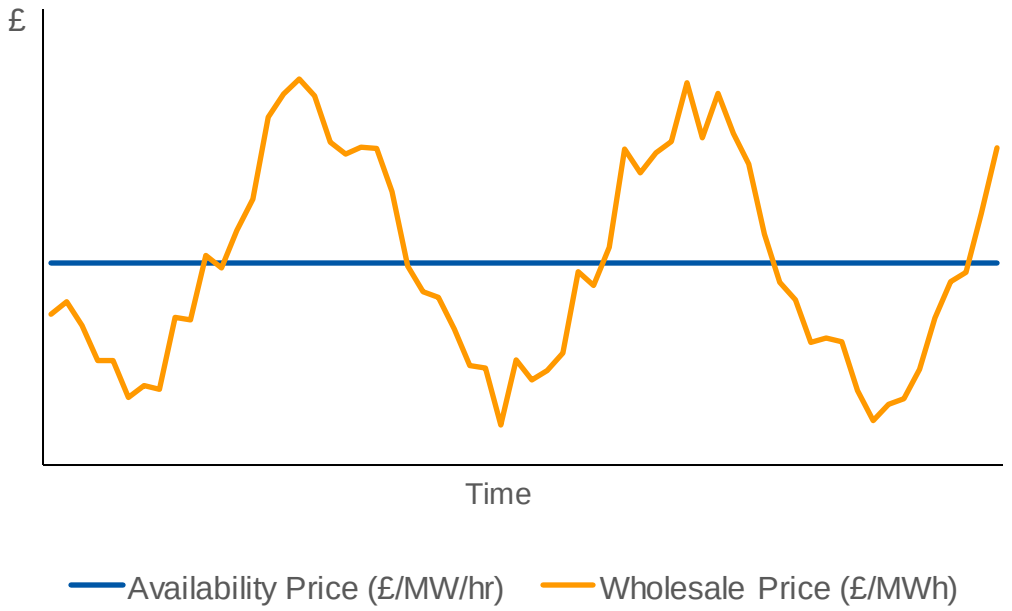


Option 2 is for contract design in a centrally planned system to pay generators for their availability to avoid distorting wholesale markets

Option 2 Formalises Central Planning of Generation and Storage Technology

Key Features of this Option:

- As in the status quo:
  - A central planner would decide what technologies, capacities and locations are needed to meet customer demand and decarbonisation objectives
  - Generators compete in tenders to provide the pre-specified projects as cheaply as possible
- Generators would be paid for making their capacity available, with despatch centralised by a System Operator based on costs, availability and technical characteristics of projects
  - i.e. generators have no commercial interest in power prices
- Some competitive trading activity may be possible on the fringe, e.g. if DERs or uncontracted generators are able to bid into the SO's centralised despatch and receive/pay the clearing price for accepted bids/offers



Concluding points on changes in market design needed to ensure efficiency during the transition to net zero

- The traditional market design is “breaking at the seams”, due to a variety of factors:
  A. A core product definition that reflects the needs of the power system ever-less closely
  B. Government intervention to address climate change policy undermining investments delivered through a competitive market
- Reforming (B) requires long-term investment contract design that either:
  – Reflects the generation mix is centrally planned and avoids distorting the market; or
  – Provides certainty to generators and investors who can meet customers’ needs with a decarbonised supply.

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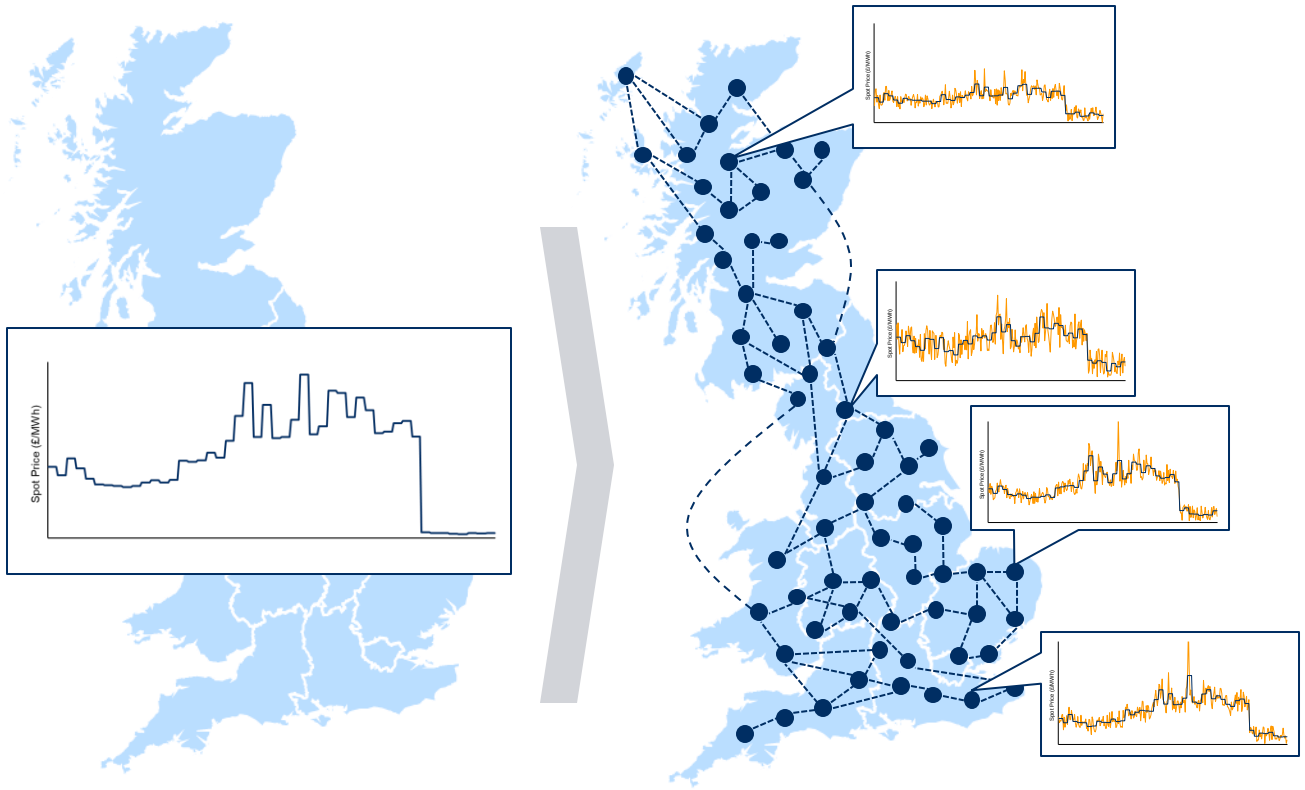
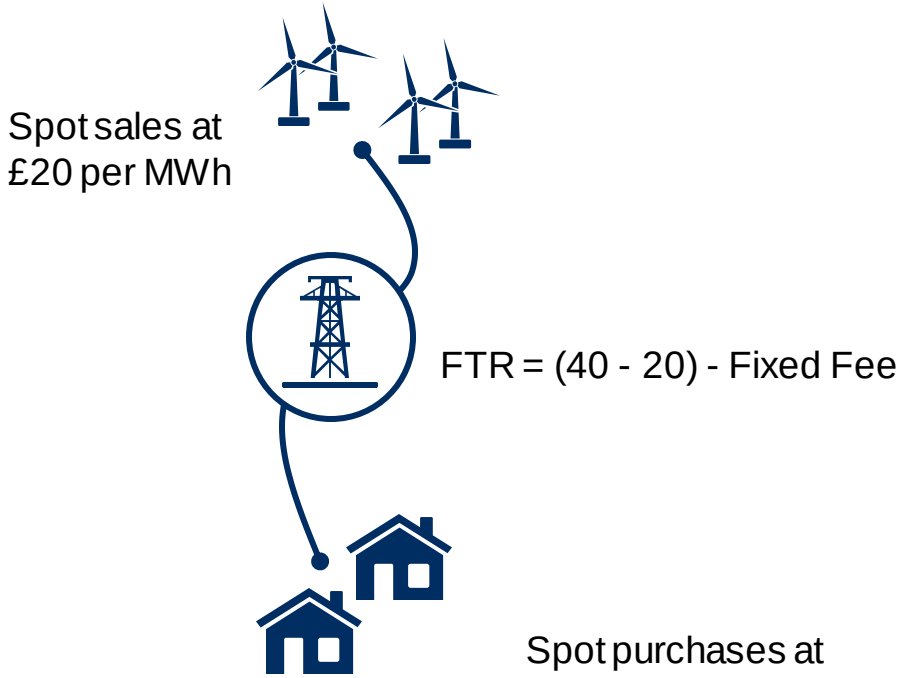
Locational energy pricing would be especially contentious and challenging to implement; zonal pricing may be a compromise

Increasing the time and locational granularity of price signals aligns the wholesale market with system needs



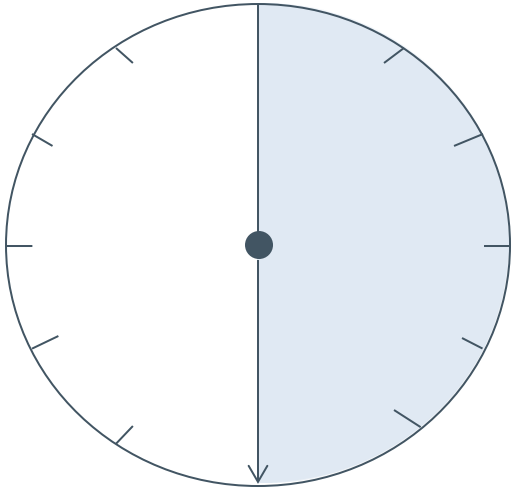
Financial Transmission Rights (FTRs) provide a vehicle for generators to hedge basis risk between nodes



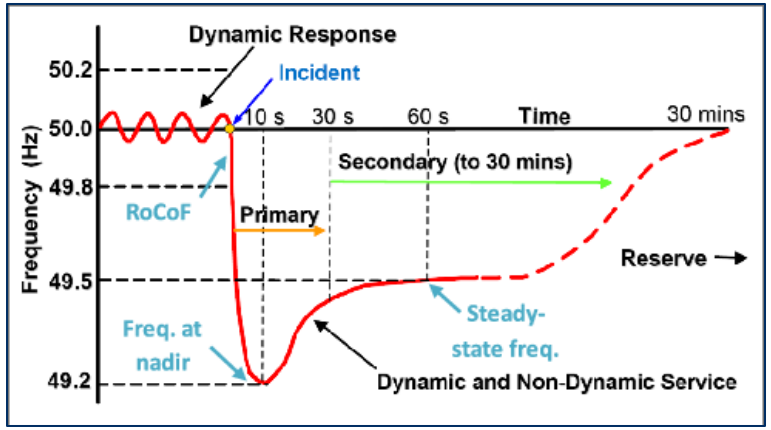
Importantly, the standard market design focuses on a product definition that was an approximation for system needs

- The delivery of energy anywhere on a national transmission system that typically aligns with national borders…

- … at any time in a 1 hour/ 30-minute trading interval…



- … and all services needed to balance the system in real time treated as "ancillary"[1]



1. Source: System frequency evolution after a contingency (National Grid).

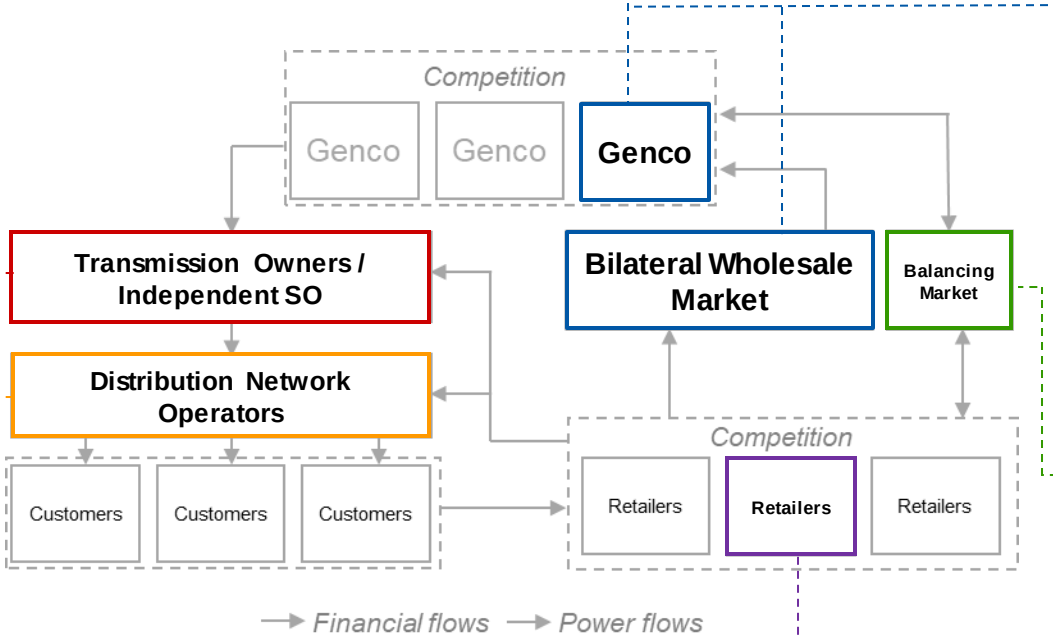
Decarbonisation policy and technological change is putting many facets of this market design under pressure

Changing Role of Networks

- System Operators are assuming new responsibilities for dispatching the system in new ways to harness new technologies and manage intermittency.
- Network tariffs are increasingly inadequate as a means of signaling the drivers of cost on transmission networks.

The Emergence of DERs

- The power market is structure to allow a one-way flow of power (G>T>D), but the emergence of DERs and new technologies means new markets are needed to capture the value they create for offsetting distribution reinforcements (i.e. flexibility contracts)
- New tariffs and pricing structures may also be needed at the end user level to support new technologies like EV smart charging



Changes and Competition Concerns in the Retail Market

- The traditional retailing model may change, with the emergence of new business models targeting "smart" services, e.g. smart appliances, EV charging, etc.
- The British retail market also has a long history of regulatory concerns about the competitiveness of the market, and is gradually returning to regulation, e.g. via default price caps

Impact of Government Involvement in the Generation Market

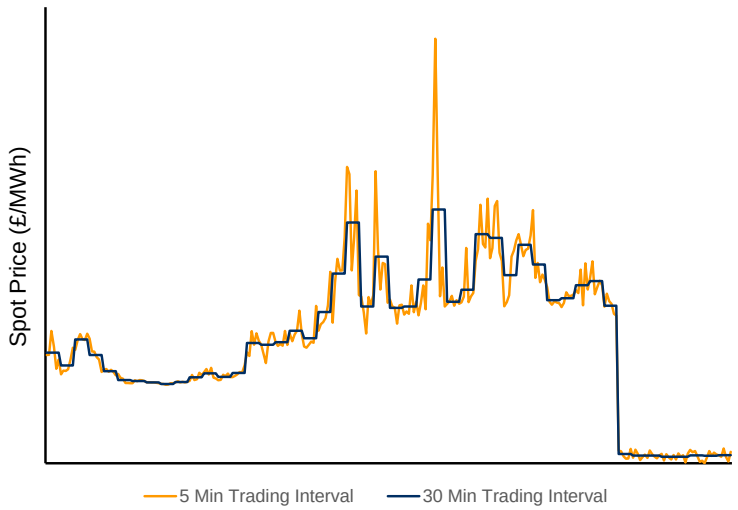
- Government policy now dictates the fuel and technology mix to a very large extent due to decarbonisation and industrial development policy, so the competitive market alone cannot support investment for most assets
- A "patchwork quilt" of subsides are now paid to generators to achieve government objectives, and most investment needs to be underpinned by a long-term contract with the government or a regulated monopoly (i.e. LCCC, the ESO or a DNO)

Increasing Role of Balancing Services

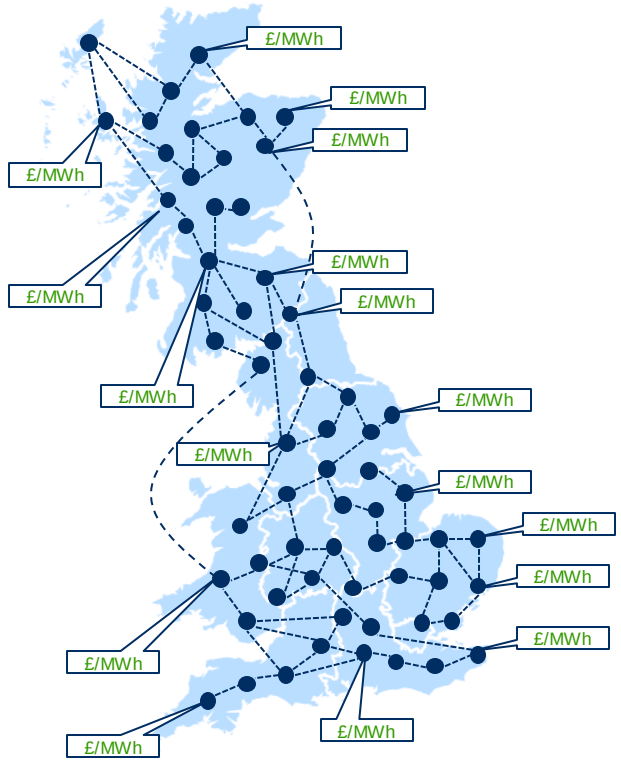
- Energy delivered over 30 minutes is becoming less relevant to capturing the needs of the system, e.g. the system operator is developing more reserve products to deal with intermittency and loss of inertia which was a free byproduct of the thermal system
- For some products competition is not possible, where there are limited providers, e.g. black start and reactive power in some parts of the grid.

Reforming the wholesale market can better account for generators' production shape, location and capabilities

Shorter Trading Intervals

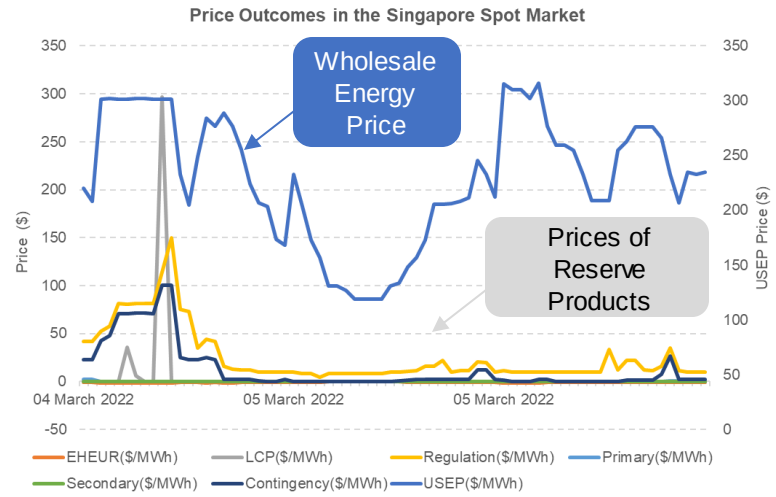


Locational Marginal Pricing and Financial Transmission Rights



Co-optimisation of Energy and Reserves

Under co-optimisation the SO runs a despatch algorithm which selects the least-cost way of meeting both energy and reserve requirements, and produces transparent prices for each product for each trading interval



These suggestions address the inability of the current design to reveal the cost and benefits of technologies which will be required in a low carbon system