

“REMA: Splitting the Wholesale Market”
Remarks to BIEE Webinar, 26th Sept 2023

Michael Grubb* (Professor of Energy & Climate Change)

Institute for Sustainable Resources – University College London (UCL)

- **Motivations and contextual developments**
- **A digression: the perapple market**
- **Which electricity market stage?**
- **A ‘Green Power Pool’ – a basic concept for consideration**
- **Concluding remarks**

* Also former Senior Advisor, Ofgem (2011-2016)

& Chair UK Panel of Technical Experts on Electricity Market Reform (2016-2019)



Accelerating developments - what a year ...

UK

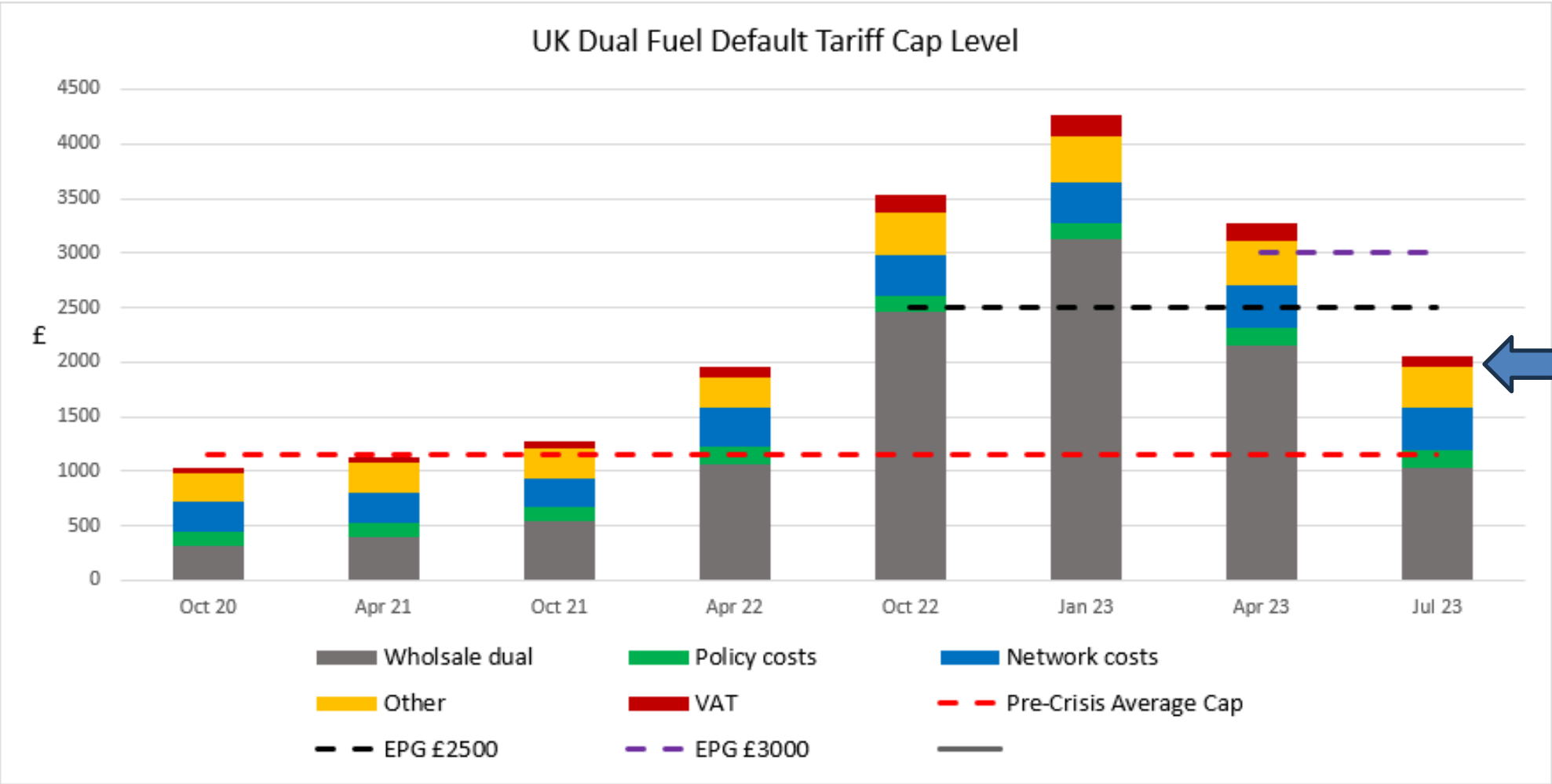
- General (£400 rebate) + targeted fiscal supports
- Windfall tax on oil and gas north-sea production
- Hints of electricity windfall tax, backed off given complexity
- **New PM** – no windfall taxes; Energy Price Guarantee for 2 years (domestic), cost estimate c. £150bn
- **Another new PM**
 - 17 November* - “.. Not responsible to continue exposing public finances to unlimited volatility ..”
 - Will “design a new approach that will cost the taxpayer significantly less”, by targeting those in the most need.
 - “...new powers to help sever the link between high global gas prices and the cost of low-carbon electricity...”.
 - to “curb the amount generators can make” ..

EU

- Single Electricity Market, product of decades of effort sacrosanct
- Iberian exception – capping cost of gas for power generation
- Several member states introduce windfall taxes; Macron renationalises EDF
- Focus on gas procurement and gas market
- **German proposed £200bn subsidy**
- **+ revenue/profit limit** on ‘inframarginal’ generation
- Late October: Announcement of major review based on need to reform EU Single Electricity Market



Household average bill through the energy crisis



July 2023 and Winter 2023/24 projections around twice pre-crisis levels

Source: P.McNally, C.Brown, S.Maximov, M.Grubb (2023): www.aldersgategroup.org.uk/publications/post/the-case-for-a-social-tariff-reducing-bills-and-emissions-and-delivering-for-the-fuel-poor/?origin=



Generator Revenues in 2022



Increase of c. £30bn split roughly equally between fossil fuel and non-fossil generation

	2018-2019	2022	Increase
Case 1 (simplified analysis based purely on day-ahead prices)	£21bn	£65bn	£44bn (200%)
Case 2 (forward contract estimation)	£20bn	£49bn	£29bn (140%)

Total revenues increase

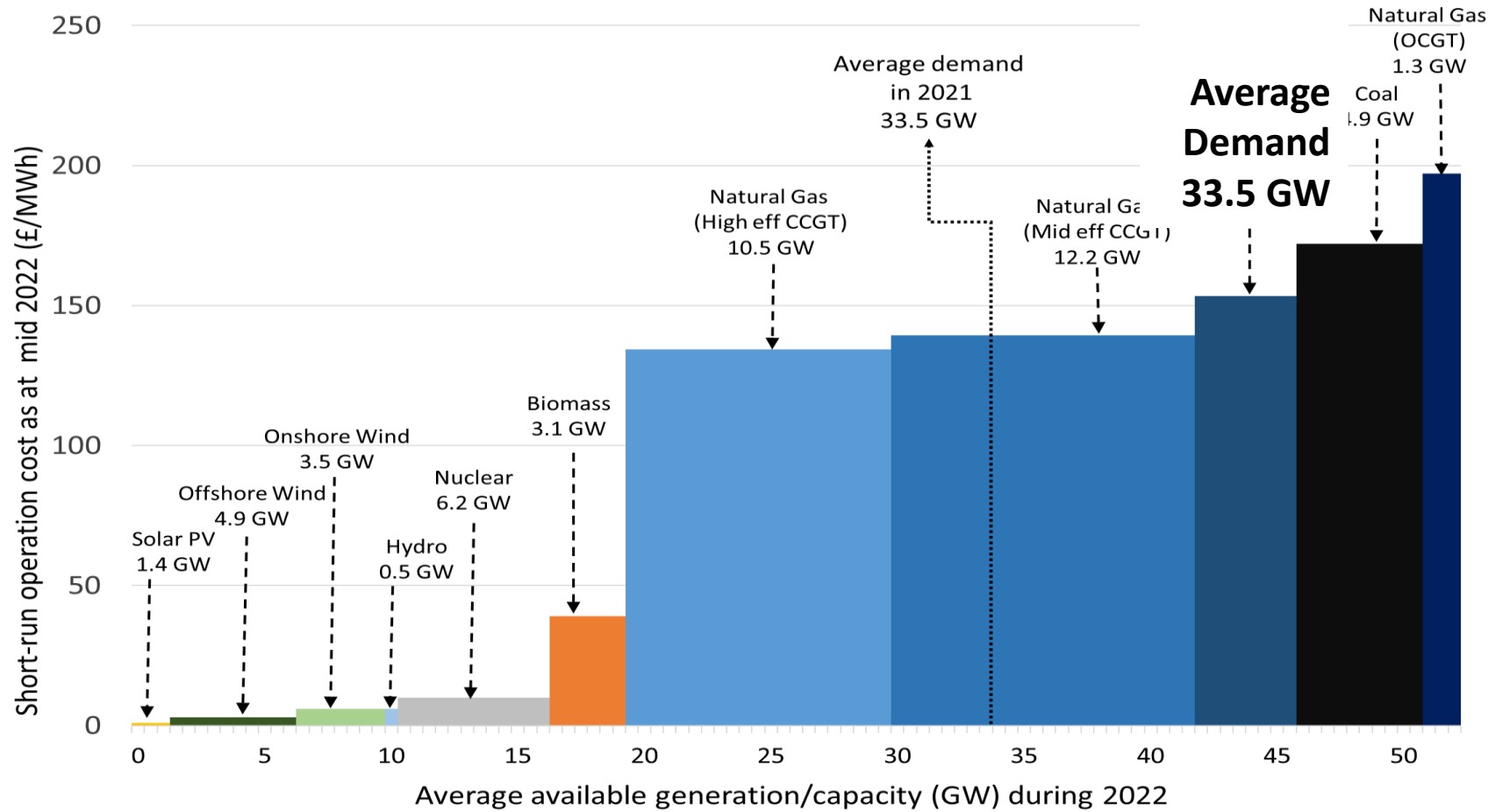
Our “Case 2” estimates based on most plausible assumptions about forward contracting:

	Increase £	Increase %
Gas	↑ £13bn	200%
Nuclear	↑ £1.8bn	66%
Biomass	↑ £3.6bn	130%
Wind Onshore	↑ £4.1bn	143%
Wind Offshore	↑ £5.1bn	110%

S. Maximov, P. Drummond, P. McNally, M. Grubb (2023), “Where does the money go? An analysis of revenues in the GB power sector during the energy crisis”, www.ucl.ac.uk/bartlett/sustainable/sites/bartlett/sustainable/files/necc_working_paper_2_final_pdf_with_cover40.pdf

The short-run marginal cost is *discontinuous*

– and the volume of very-low-short-run-marginal cost is growing rapidly



UK data as at mid -2021

=> [How long] can the diminishing tail wag the growing dog?

The Pearapple market



From Commodity to Assets & a new electricity system?

VREs and the ‘new electricity system’ are *different* in many ways, inc. active consumer role

	Traditional	New electricity system
Generation	<p>Baseload + flexible</p> <p>Costs generally dominated by fuel (& other operating) costs</p> <p>At the margin, price-setting</p> <p>Differentiated prices reflecting variable costs</p> <p>Economies of scale</p>	<p>Variable, inflexible</p> <p>Capital intensive – costs dominated by capital</p> <p>In wholesale markets, renewables price taker + storage (batteries, CHP, hydro, biomass)</p> <p>Economies of location</p>
Demand	<p>Variable,</p> <p>Inflexible</p> <p>Mostly fixed tariffs</p>	<p>Baseload + seasonal</p> <p>Growing flexibility</p> <p>Differentiated / ToU pricing</p>
Transmission	<p>One-way, from gen to consumers, bulk</p>	<p>Two/multi-way, peak needs</p>
Other services	<p>System inertia, frequency control etc largely inbuilt</p>	<p>System inertia, frequency control etc – need for separate service markets / incentives , balance supply and demand capabilities</p>



What stage of the electricity market are we talking about?

Investment	Wholesale	Suppliers / Retail (“load serving entities”)	Final consumers
<p><u>Current</u></p> <ul style="list-style-type: none"> • Merchant • CfDs <p><u>Bilateral</u></p> <ul style="list-style-type: none"> • PPAs • Self-generation <p><u>Legacy</u></p> <ul style="list-style-type: none"> • ROCs • FiTs 	<ul style="list-style-type: none"> • Day-ahead (DA) sales • Market with CfDs¹ with compensating transfers w.r.t. <ul style="list-style-type: none"> → DA reference price (wind & solar) → Bi-annual reference price (e.g. biomass, nuclear) • Forward contracts • PPAs: various indexing: <ul style="list-style-type: none"> → Fixed price → DA or other market price • Constraint payments to not generate 	<ul style="list-style-type: none"> • Wide variety of purchasing and marketing strategies • Almost all: explicitly or implicitly, costs are linked to wholesale • Large-scale bankruptcies in 2022 arising from gas-driven wholesale price • Regulatory action considered in UK (capital / etc) and US (discourse on ‘mandatory hedging’) 	<ul style="list-style-type: none"> • Wholesale + multiple add-ons <ul style="list-style-type: none"> ... including + / - CfD payments • .. some direct access agreements through PPAs • ‘Green tariffs’ Wholesale + add-ons + ROC / REGOs

⇒ The current system is far from simple... and across all stages, **the market is already significantly split**
 1: Treatment of Wholesale CfD changes between Rounds 1-3, and 4+ with ‘no negative price sales’]: means ROCs and Rounds 1-3 may outbid new CfD investments out of generation]

So:

- Need clarity about what stage of market
- The investment and wholesale parts of the market are already to a significant degree split (and the rest is complicated particularly for those who want to 'buy green')
- The current system is *not simple*

If only incremental changes:

- *The problems will grow as the share of non-fossil grows towards 80/90%, with variable renewables > 50%, increasingly dominated by CfDs*
- With (almost) all generation going through a market where the price:
 - flips between the cost of fossil fuel generation, or
 - something close to zero (times of cannibalisation)
 - With the newest generators – the new renewable investments we want, on Round 4+ CfDs – facing the greatest risks
- *Really?*
- Proposals:
 - Split market: OIES proposal
 - Dual market: A 'green power pool' – *for example*, aggregating output from variable renewables, or from CfDs, through a GPP System Operator



A targeted 'Green Power Pool' (GPP) – an initial focus?

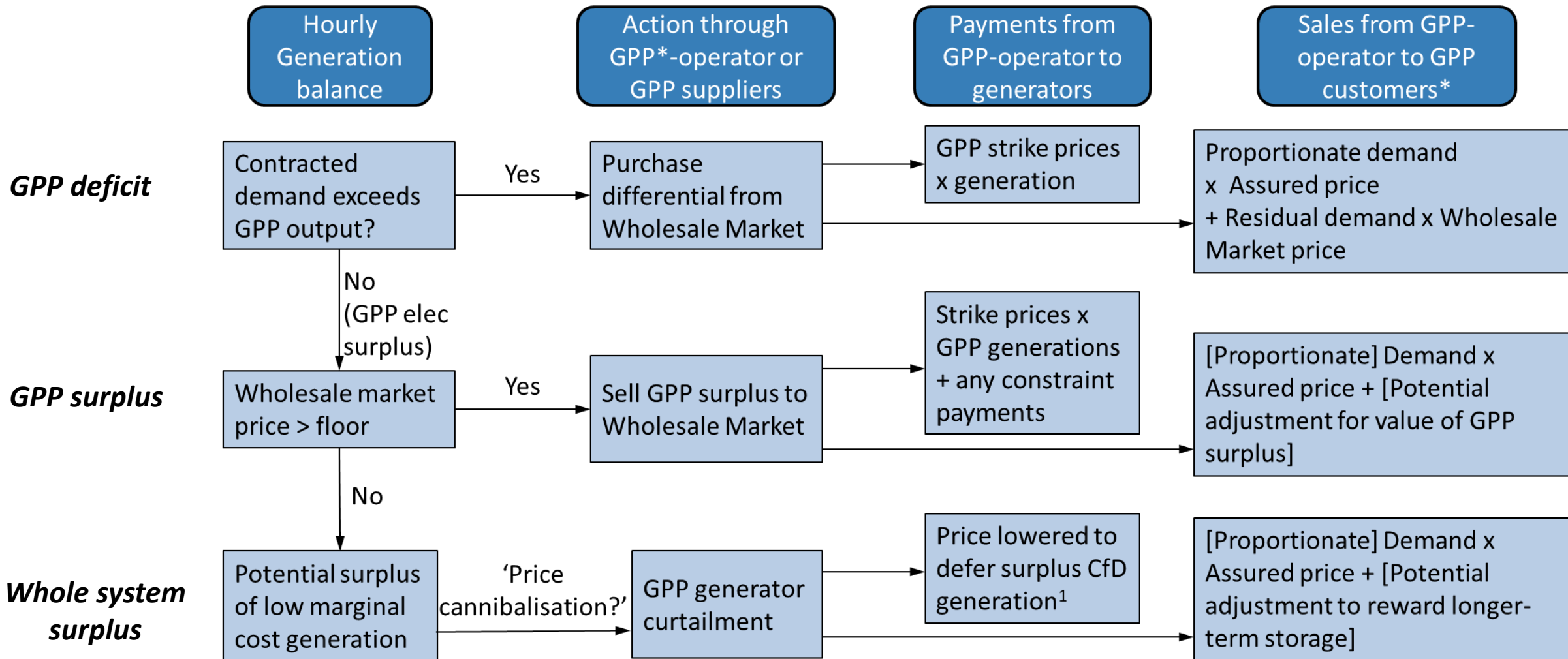
- Start with generators already on government backed long term contracts, with fixed prices
- Sell this volume of electricity through to consumers on real-time basis

Consumer contract costs and variability - Physical and consumer cost states Green Power Pool

GPP Physical state	Physical flows and payments with wholesale market (simplified model)	Consumer costs (simplified model)
Pool generation is surplus to pool demand	Pool/generators sell surplus power to wholesale market	Pool consumers pay the ' assured price ' (real-time average strike price) for all their electricity consumption*
Pool generation is insufficient to meet pool demand	Pool buys additional power from the wholesale market to meet demand	Additional costs passed through to pool consumers, applied to demand exceeding their 'proportionate' share of Pool supply, as either <ul style="list-style-type: none"> • a changing unit price as the volume of purchase required by the pool grows, or • "two-tier" pricing, i.e., with the proportionate power at the assured price, additional power charged at the wholesale market price (if suppliers have capacity for such contracts)

– *Simplified contract structure for conditions of surplus. See also slides 10 and 18





*GPP = Green Power Pool, GPP customers may be suppliers or direct consumers (e.g. industry); Assured price = weighted-average generator strike price
 Wholesale Market = Wholesale (operational /day-ahead) market reference price. ¹For CfD contracts defined in terms of guaranteed MWh of remuneration

- Three “archetypal” options for avoiding the problems of ‘short-run-marginal cost-on-all’

- ***General distribution through suppliers***

- Suppliers combine electricity from GPP with wholesale and other contracts
- OR differentiate, to compete with longer-term offerings
- If significant enduring cost difference (and GPP supplies limited) may require
 - Governance to ensure cost savings are passed through the price of electricity [recall experience with ‘free allocation’ of ETS allowances to power producers ...]
- And to present on-selling / arbitrage if & when the GPP is much cheaper than wholesale

- ***[Household] rising block tariff***

- A variant on above, probably with a government requirement for suppliers to provide a base volume at lower cost
- Draws on large literature and some international experience on rising block tariffs
- Aggregate progressive in distributional consequences though can be awkward exceptions
- Some other dimensions as above

- ***Targeted***

- Particular consumer groups are prioritised – potentially both industrial and domestic - on grounds of particular need / other characteristics
- Potentially, replacement for the current range of fiscal supports
- Politically difficult choices of any targeting
- Pros and cons of conventional fiscal, explicit financial redirection of CfD payments, or GPP through electricity price



Multiple pools, voluntary matching of demand and low-carbon generating sectors ?

A. CfD-backed GPP

Generators: Those with (auctioned) CfDs, potentially co-located storage

Demand (if targeted): Internationally most at-risk businesses (e.g. steel), and vulnerable consumers (through franchised suppliers)

Grid (investment) charges: Potentially zonally-based transmission contra



Zonal CfDs?

Local / distributed energy systems

Generators: Small scale renewables connected to local distribution systems, inc 'Prosumers' displaced consumption & export tariffs

Demand: Households & small businesses, keen to purchase clean electricity without long-term commitment, and potential benefit from flexibility (eg. electric vehicles, heat pumps)

Grid charges: standard connections, maybe with zonal or nodal dynamic pricing adapted for local system and consumer capabilities

Wholesale / on-demand market

B. Private sector contracts GPP (untargeted)

Generators: Other large-scale renewables, generally transmission-connected, likely including conversion from large-scale ROCs; large-scale storage

Demand: likely larger business consumers (eg industrial clusters) and suppliers, seeking longer-term price clarity from very low carbon electricity, particularly if potential for flexible demand

Grid (investment) charges: Potentially zonally-based transmission contracts

Current ROCs generation

C. Power Purchase Agreements (PPAs)

Generators: Mid-size renewables (eg. large onshore wind & solar farms) & bundled storage, including new investment

Demand: business customers and suppliers with good credit rating and/or seeking to contract with local renewables, potentially with flexible demand (eg. large-scale large heat capacity or freezers)

Grid charges: standard connections, maybe with real-time (dynamic) zonal or nodal pricing

Growing scales of generation and demand, and associated levels of grid connection and likely investment timescales

Possible fuzzy boundaries and interrelationships need not deter 'differentiated markets'

Pears



Apples



No. 4337 December 13, 1952 NATURE 1017

Pear-Apple Hybrids

At the John Innes Horticultural Institution we have recently raised hybrids between pears and apples; they were obtained in the following way. The occurrence of apomixis in the Pomoideæ¹, and the high frequency of diploid seedlings, 23 out of 39, in a family of pears we raised from crossing the diploid variety Fertility with the triploid variety

the hybrids on to apple seedlings, it appears that difficulty in growth may be overcome.

One seedling in each family has been examined cytologically by Mr. R. D. Brock: the one in which the tetraploid apple was the male parent was triploid and the one with the diploid apple parent was diploid. This supports their hybridity.

In the past we have made pollinations between apples and pears but never obtained seeds. They

BOTANIC NOTABLES: THE LATEST HYBRID "PAPPLE"

By Anna Laurent

[FREE WEEKLY NEWSLETTER: Plants, Design Ideas, Gardening Solutions & More!](#)

A new fruit hit [markets](#) in the U.K. this week. Round, red, sweet, and juicy, the hybrid fruit is [described](#) as a pear disguised as an apple. Until it receives an official name, the new fruit has been going by T109—or, to its friends, the "papple."



Annex Slides

- Structural design of a targeted Green Power Pool
- Numbers – projections of costs and volumes for a GPP based on CfDs
- Relationships to Power Purchase Agreements and legacy (ROCs)

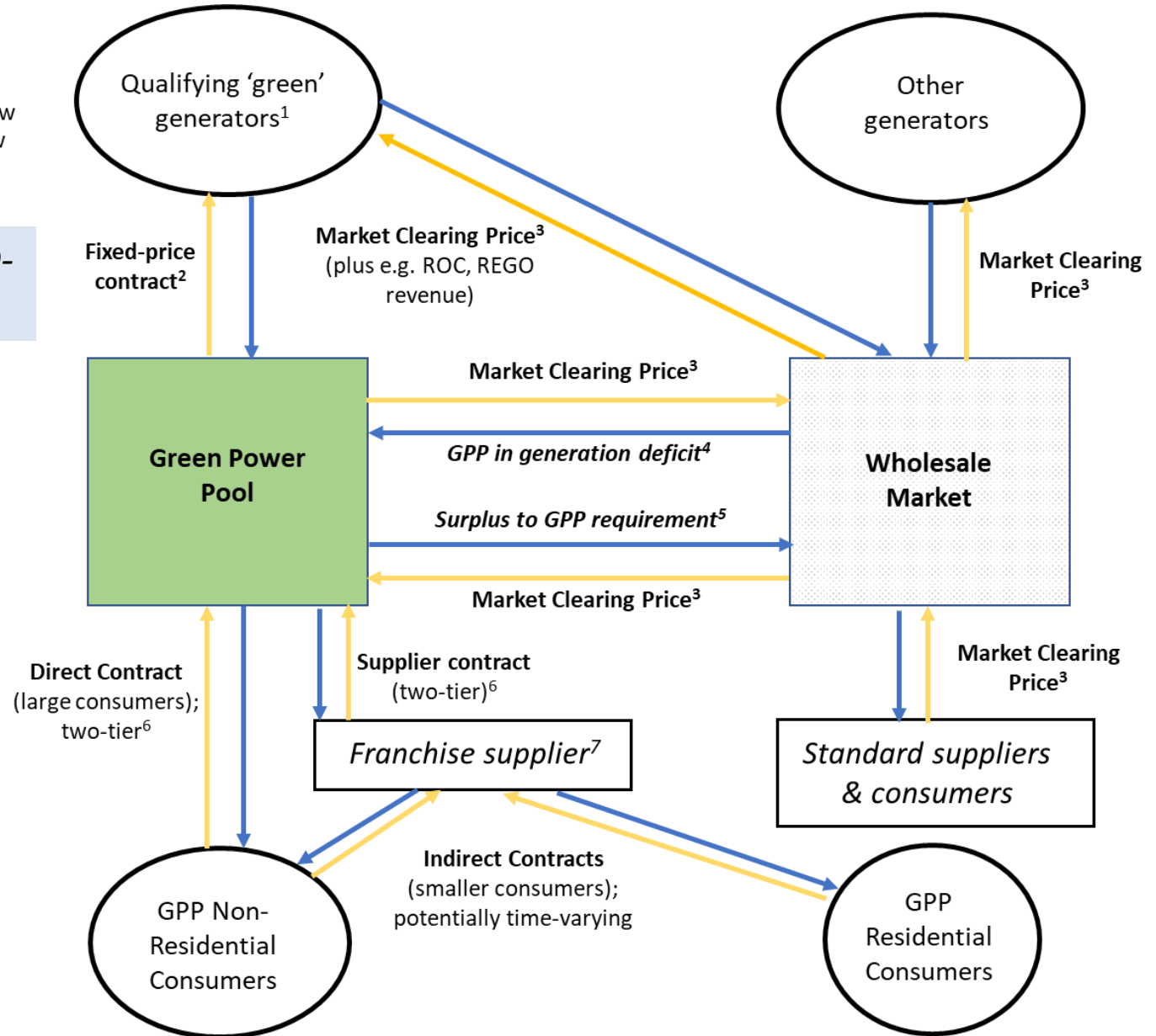
All data / charts available at the UCL site ‘Navigating the Energy-Climate Crises’,* to date:

- *Two stakeholder reports with Aldersgate Group (on **industry and electricity decarbonisation**, and on **consumer tariffs**)*
- *Four working papers: (#1 – Marginal cost pricing – Empirics; #2 - Revenues during the energy crisis; #3 – Economic Principles & reform criteria; #4 Green Power Pools)*



Electricity and financial flows through a CfD-derived Green Power Pool

— Electricity flow
— Financial flow

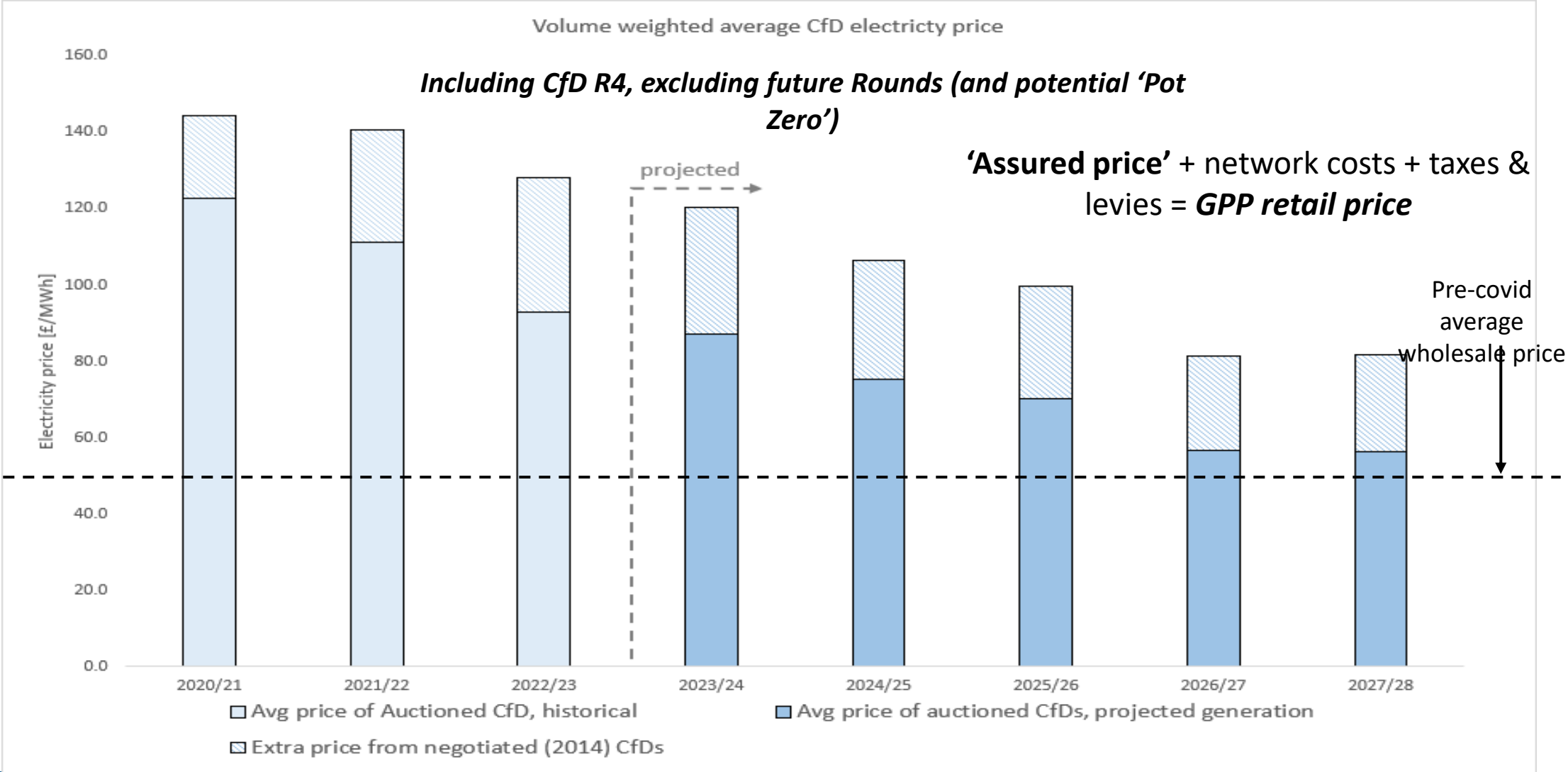


1. Specific generator qualification criteria may vary
2. Fixed price per unit of generation, as per CfDs.
3. A combination of spot and forward market sales, as appropriate
4. At times when the generation in the GPP cannot satisfy its consumers' needs, the pool itself could buy from the wholesale market
5. At times when the GPP has surplus electricity (exceeding its consumers' needs) the pool itself could sell to wholesale market, or limit its own purchase from GPP generators who then sell surplus to wholesale market
6. Two-tier contracts combine involve a fixed unit price (reflecting cost of the CfD contracts), with a variable component reflecting trades with the wholesale market
7. Franchised supplier, passing GPP costs through with cost+ margin, regulated to prevent on-selling



Might consider integration of LCCC with FSO?

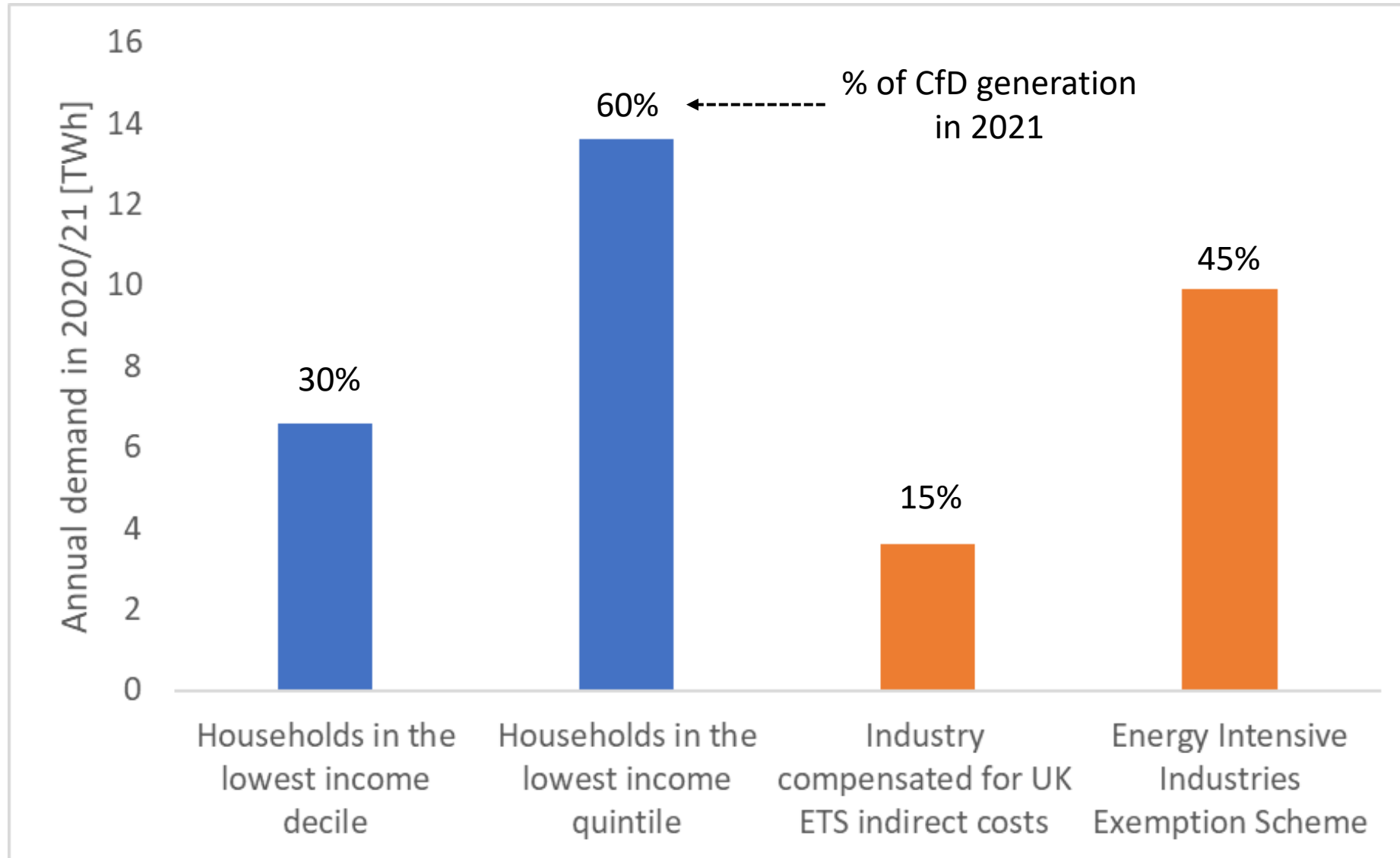
Weighted-average CfD strike prices



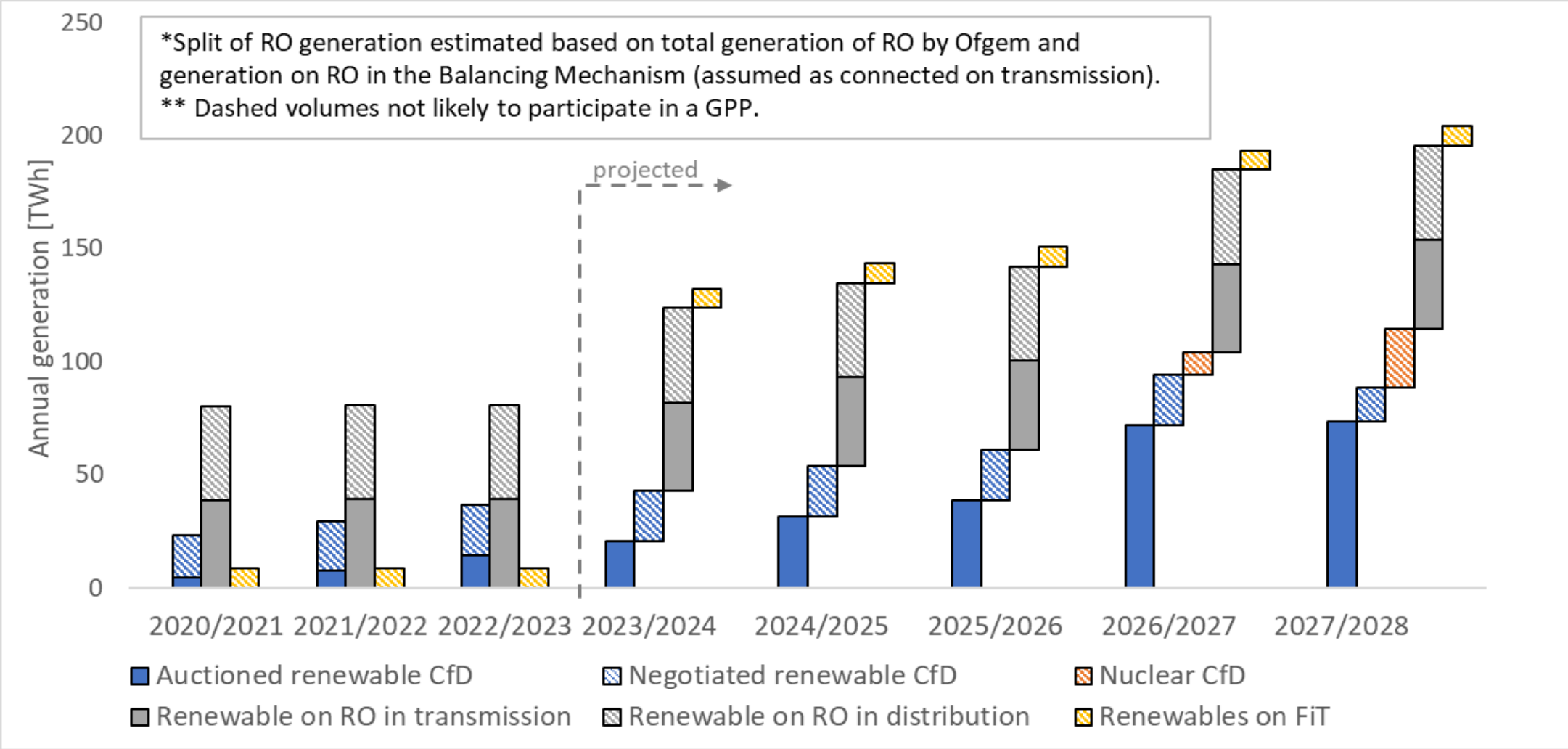
Grubb M., P.Drummond, S.Maximov (2022), Separating electricity from gas prices through Green Power Pools: Design options and evolution. Navigating the Energy-Climate Crises, Working Paper #4, available at <https://www.ucl.ac.uk/bartlett/sustainable/research-projects/2022/sep/reforming-electricity-markets-low-cost-and-low-carbon-power>

Which (initial) consumers to target?

Annual consumption vs CfD generation



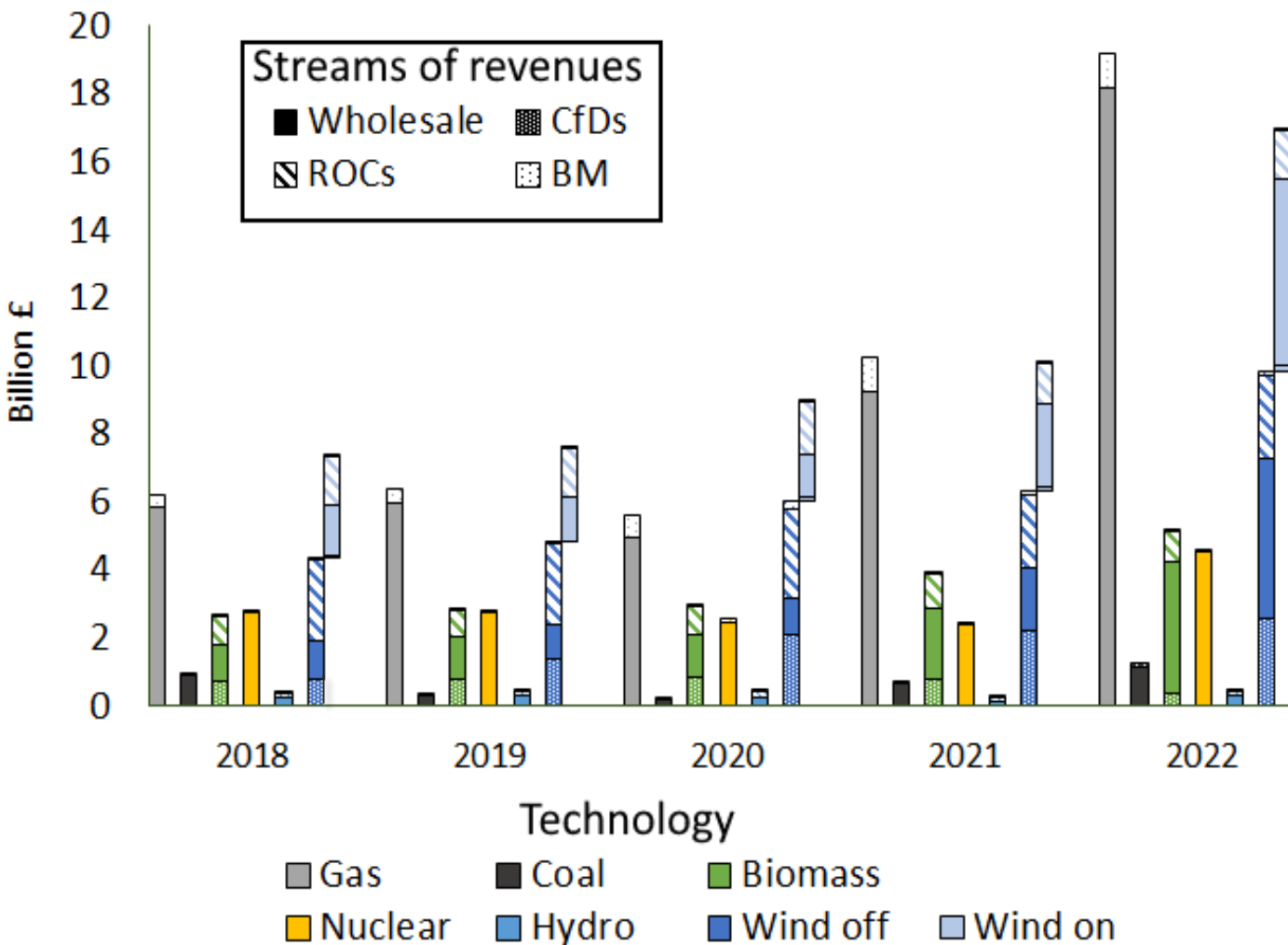
Projected low-carbon generation



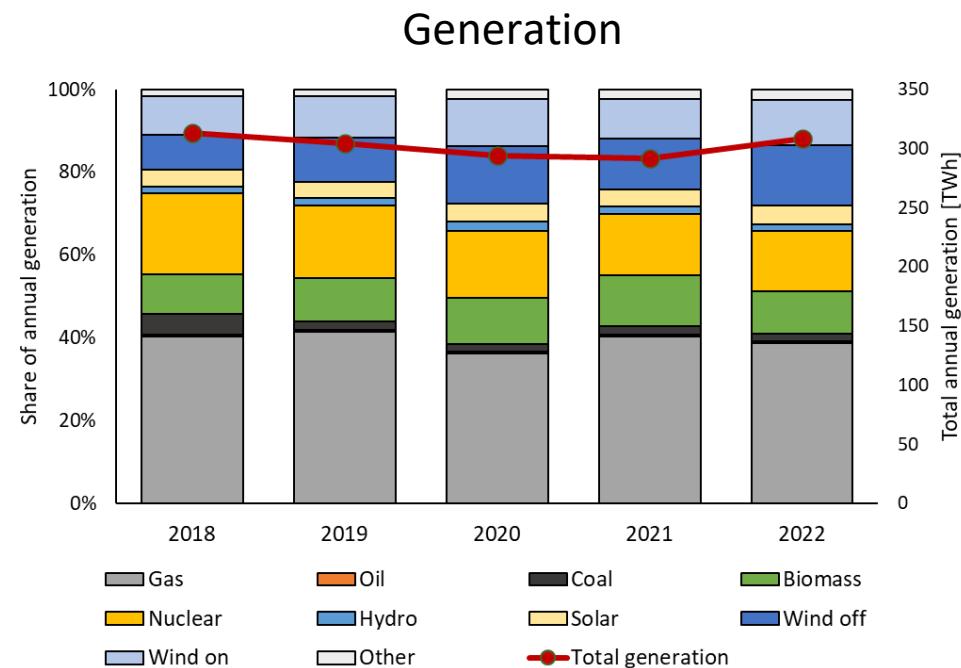
Revenues change – focusing on Case 2



Absolute revenues per technology



Change in installed capacity makes it difficult to separate the effect of volume and price.



Source: DUKES

- **Reflects and facilitates evolution towards very low carbon system**, meeting the ‘five principles’
- **Compatible with other market reform options** – e.g. greater market exposure for new CfDs.
- **Does it require the state to impose a mandatory Green Power Pool for all renewables?**
 - Not necessarily: that would carry significant risks (hence start with existing CfDs)
- A GPP **could be extended through PPAs**, or parallel PPA market?
 - Requires evolving institutional structures/relationships
 - Or, opportunity for knowledge/experience-sharing
- Long-term – need to adjust **structures and responsibilities of Pool operator vs System operator**, as relative scale increases?



Costs: marginal vs average pricing

Potential savings from moving to average pricing under three scenarios of energy prices

	Scenario 1: Pre Crisis		Scenario 2: Peak Crisis		Scenario 3: New Normal	
	Average	Marginal	Average	Marginal	Average	Marginal
Final Bill (annual)	£1083	£1012	£2992	£4279	£1338	£1497
Saving per Household (annual)	£71	£0	£1287	£0	£160	£0
Savings across GB (annual)	£1.9bn	£0	£35.1bn	£0	£4.4bn	£0

Source: P.McNally, C.Brown, S.Maximov, M.Grubb (2023): www.aldersgategroup.org.uk/publications/post/the-case-for-a-social-tariff-reducing-bills-and-emissions-and-delivering-for-the-fuel-poor/?origin=

