

Presentation to CEEM conference

*Emergency interventions in electricity markets: which long term legacy?*

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For underlying sources and ongoing research see series, ***Navigating the Energy-Climate Crises***, at  
<https://www.ucl.ac.uk/bartlett/sustainable/research-projects/2022/sep/reforming-electricity-markets-low-cost-and-low-carbon-power>

## ‘Politics as the Art of the Necessary (and possible) .. ?

- UK buys gas from international markets
  - original mantra “that’s OK, we buy from international markets”
  - V. little Russian gas
  - Err ... Need to intervene
- Context:
  - relatively inefficient housing stock
  - gas-dominated electricity system with moderate interconnection
  - Previous regime included regulated price cap on ‘standard default’ tariffs
  - A very visible index of the impact of the energy crisis on forthcoming bills ... from around £1000 per household, rising sharply, to projections this summer over £4000 +
- Political bidding to show understand devastating impact of high bills => generous emergency financial support
  - Initial: £400 to all energy consumers + £650 for benefits + some others .. With oil & gas ex-ante windfall tax
  - New Prime Minister Liz Truss:
    - Had campaigned on basis of ‘no windfall taxes – deter investment’, and generally reducing taxes
    - Precipitous action – September announced that annual bills would be frozen at average £2500/yr for next 2years
    - Paid for by ... direct government subsidy, funded by borrowing
      - £150bn to cover the domestic package
      - C. another £30bn+ to cover business electricity (rates at about half those of the domestic package), for next 6 months
  - Subsequent financial fiasco



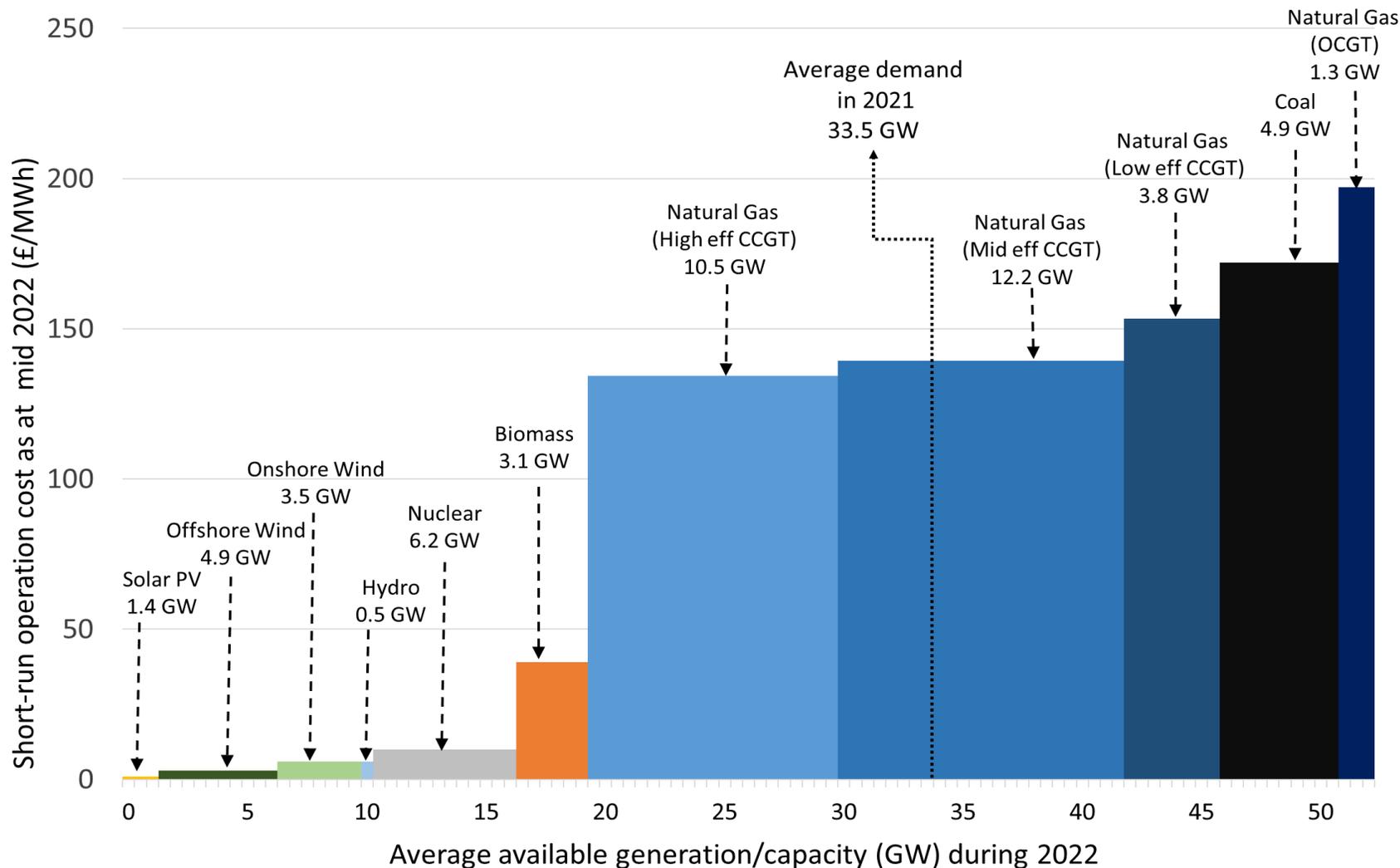
## The electricity sector ... ?

- REMA 'Review of Electricity Market Arrangements' had already been launched
  - but largely with a focus on market design e.g. locational
  - Major consultation paper, responses close today
- Now a major focus political:
  - electricity about half domestic bills
  - a problem for industry
  - Political and public debate already querying why electricity prices set by gas (84% of time in 2019, according to paper published on our UCL-NECC website)
  - Will emerge that electricity proportion becomes higher if and when gas prices decline, due to forward contracts
- Unclear political position re gas price caps
- ... last week, press indicated that a cap on profits or revenue for renewables & nuclear likely, "as soon as next week"



# The short-run marginal cost is discontinuous

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



UK data as at mid -2021



## Current and projected system

- Non-fossil sources already amount to almost two-thirds of generation in, projected to rise to three-quarters of generation before 2030
- Cost inversion between renewables and traditional fossil fuel generation sources is likely to be a sustained rather than a transitional reality
- Changes to electricity market design and supporting infrastructure are needed: rapidly growing transmission constraints, periods of demand and supply imbalance, electricity price ‘cannabilisation’, etc.

		Non-fossil fuels			Fossil fuels
		Wind & solar	Hydro & Biomass	Nuclear	
EU + Norway	2020/21	542	667	684	991
	2026/27	1020	669	568	794
	2030	1225	669	519	710
UK	2020/21	89	46	50	127
	2026/27	194		35	73
	2030	235		43	46



# The wider intuition / foundation: *from commodity to assets*; VREs and the ‘new electricity system’ are *different* in many ways

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



## Some underlying economic observations

*“Electricity is Different”*

- Walt Patterson (2007), in *Keeping The Lights On* (Chapter, *Electric Challenge*)

•

*“No method of economic analysis can determine, scientifically, what to do about the gap between average and marginal cost”*

- J.R.Nelson (1963), in *The American Economic Review*

The problem is not marginal cost pricing, but  
***short-run-marginal-cost-on-all pricing***

*Underlying theory and evidence examined in Navigating the crises in European energy: Price Inflation, Marginal Cost Pricing, and principles for electricity market redesign in an era of low-carbon transition*



# Proposition – regulated Dual Markets approach (linked markets)\*

## *Spot & frequency markets*

- The operational market
- Value of electrons enhanced by system management services
- LMP or similar evolution for locational signals
- most likely attractor for dispatchable plant investment
  - Pays carbon price
  - Gets paid for its backup & balancing services
  - Gas and carbon price pass through

## *Long term contracts – a ‘Green power pool’*

- *standardised structures* of long-term, tradeable zero-carbon electricity contracts. Avoids *direct* impact of gas and carbon prices for electricity purchased through these contracts.
- Aggregated through a ‘green power pool’ to minimise collective System balancing and backup costs
- Customer offering demand flexibility and other system services benefit through contract structures
- Other balancing purchased by the pool operator from the spot market, costs passed on to contract holders
- Supply-side built upon current structure of CfDs and Low Carbon Contracts Company?

Standardisation and transparency through Contracts Market Maker  
and their published purchases from the spot & frequency markets via the System Operator

\*From our 2018 report: See also Oxford OIES split markets proposal, and their recent suggestion of a pilot experimental auction, <https://www.oxfordenergy.org/publications/glimpses-of-the-future-electricity-system-demand-flexibility-and-a-proposal-for-a-special-auction/>



## A CfD-derived Green Power Pool

- CfD generators are already on government backed long term contracts could be moved to a GPP.
- Targeting priority groups?: vulnerable households and high electricity price exposed industry.

### Physical and consumer cost states Green Power Pool

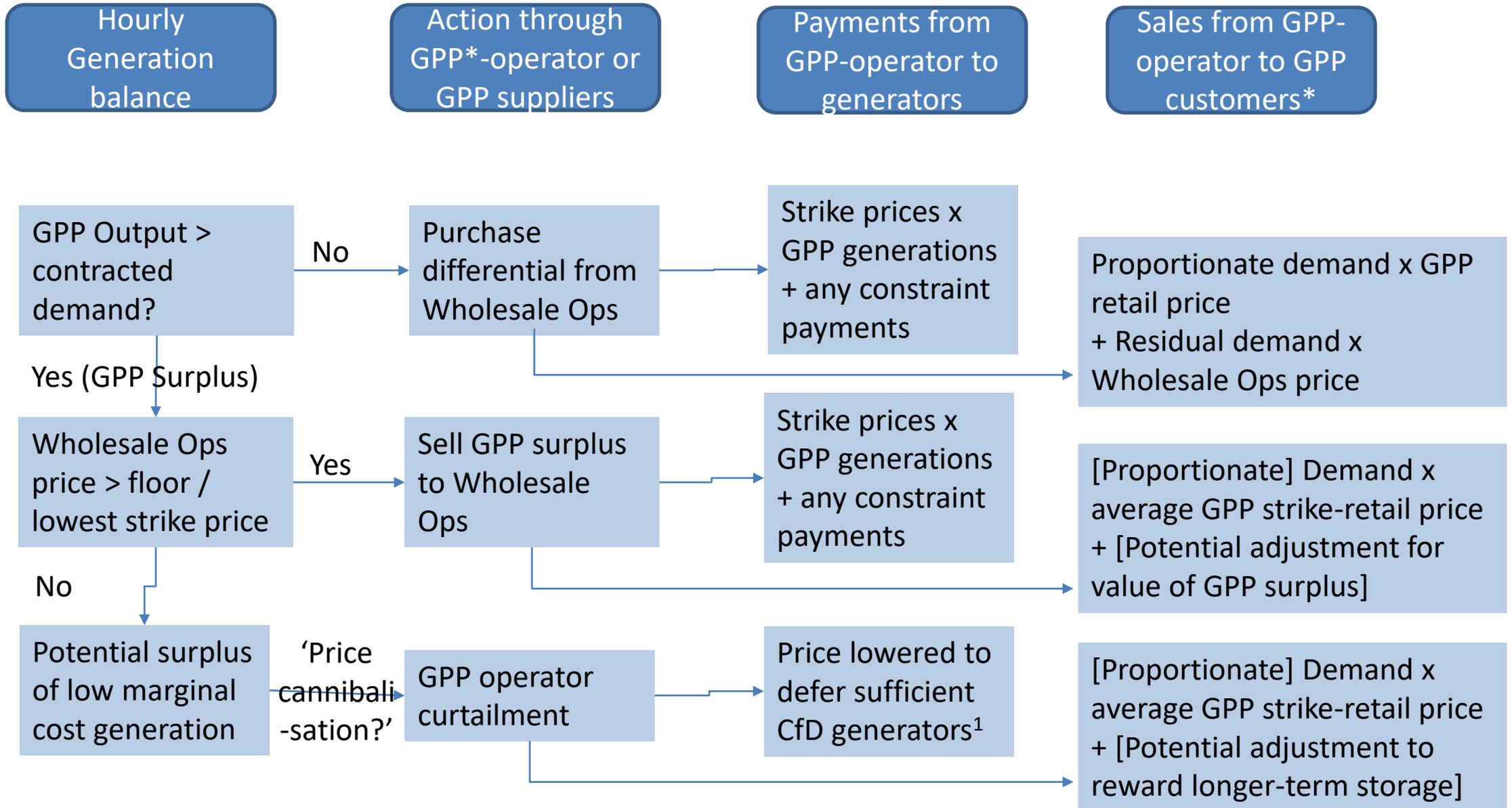
Physical state	Physical flows and payments with wholesale market (simplified model)	Consumer costs (simplified model)
Sufficient pool generation to meet pool demand, so some surplus	Pool exports to wholesale operations market, wholesale market mandated to take the power (on average-strike-price basis, before other bids)	GPP consumers pay the fixed “average-retail-strike-price” for all their electricity consumption
Insufficient pool generation to meet pool demand	Pool imports from wholesale market at the system short-run marginal price	Additional costs passed through to GPP consumers, applied to demand exceeding their ‘proportionate’ share of renewables generation, as either <ul style="list-style-type: none"> <li>• a changing unit price as the volume of purchase required by the GPP grows, or</li> <li>• “two-tier” pricing, if suppliers have capacity to implement such contracts</li> </ul>



## Some principles: economic value ...

- Minimize balancing needs & counterparty risks *cf* bilateral Purchasing Power Agreements, and contract lengths more appropriate for large-scale renewables
- *Efficient investment incentives on the supply side*
  - Maintaining efficient *financing* investment terms for capital intensive, low marg cost
  - 'market maker' or ISO has incentive to minimize net balancing costs, would be best placed to design incentives or choices for efficient location. This is because it depends on (a) forward modeling and (b) a view of the evolution of the overall system on the timescales of maximum investment return.
- *Efficient operational incentives on the demand side*
  - Design of long term contracts could build upon existing 'green power' PPAs?
  - Contractual terms to include responsiveness to wholesale prices
- Tradeability?
  - Do GPP contracts start to have characteristics akin to bond markets?





GPP

= Green Power Pool, GPP customers may be suppliers or direct consumers (e.g. industry).

Wholesale Ops = Wholesale operational market reference price. Source: Grubb & Drummond, forthcoming October



## Some principles: policy and politics

- Creates the foundations for competition in markets that reflect the basic characteristics of renewables
- Reflect the natural evolution towards very low carbon system – the need for consumers to migrate from high to low carbon electricity consumption
- Cost transparency and appropriate pricing:
  - Reveals the growing economic advantage of renewables directly through consumer options
  - Directly addresses the unending debate about “backup and balancing costs”
  - Takes the carbon price out of (directly, at least) electricity that involves no GHG emissions
  - Facilitates carbon price to be ratcheted up in more politically acceptable ways
- Analogy with how we got lead out of petrol ....?
- Philosophy – we are having this discussion because *they are not really the same product* , to which would should add, *and there is also a wide diversity of consumers* who may want to contract for different things



## Relationship to Purchasing Power Agreements

- A great deal to learn from PPAs, particularly ‘carbon neutral’ PPAs
  - PPA landscape review, an initial stage of project
- However, PPAs carry high transaction costs, counterparty risks and individual balancing challenges
- Reports of some countries (eg. Spain) trying to standardize PPA structures
- A ‘green power pool’ could be extended through PPA
  - ..... Requires some different relationships, eg. to CfD renewables
  - But clear scope for lessons and indicators of potential evolution?

