

Electricity Market Design for 21st Century power systems – a view from Europe

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Electricity Security Panel workshop, Paris 17th June 2019***

*Session: “What does the next generation of wholesale
market designs look like?”*

With data and key recommendations from report M. Grubb & P.Drummond (2018), ‘European electricity prices - competitiveness in a low carbon world’, UCL-ISR and Aldersgate Group



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Three Data Slides:

- I. Wholesale Prices across the ‘big four’
- II. Relative wholesale and renewables prices
- III. Some trends and influences on renewables costs

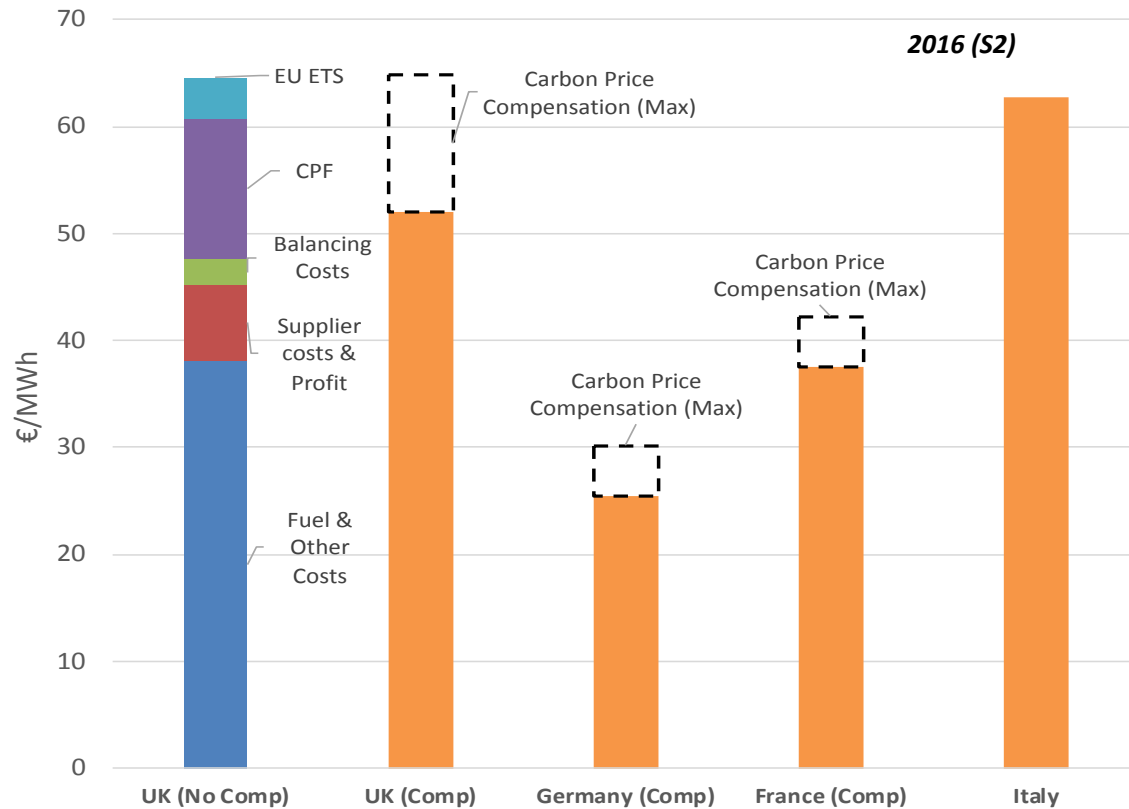
Three Recommendation Slides:

- A. Some fundamentals for unsubsidised renewables
- B. ... for both fossil and renewables in interconnected markets
- C. A “Green Power Pool” – ‘facilitated evolution’?

Conclusions



Wholesale prices vary widely across space – and time!



Energy & Supply prices across four major EU Countries, 2016

- **Rapid penetration of renewables** - shifts merit order – reducing wholesale price by €14-16/MWh in Germany 2016* (but high taxes & levies). CCC estimate Merit Order Effect of €7/MWh in GB 2016
*Cludius *et al* (2015) The Merit order effect of wind and photovoltaic electricity generation in Germany 2008-2016
- **Germany & France highly interconnected** with other countries (~10% domestic generation capacity). GB interconnection (to France, Netherlands & Ireland) currently more limited (~6% domestic generation capacity).
- **Highly volatile:** UK entered the 'sustained negative price' world on Sunday 25 May 2019, and how!

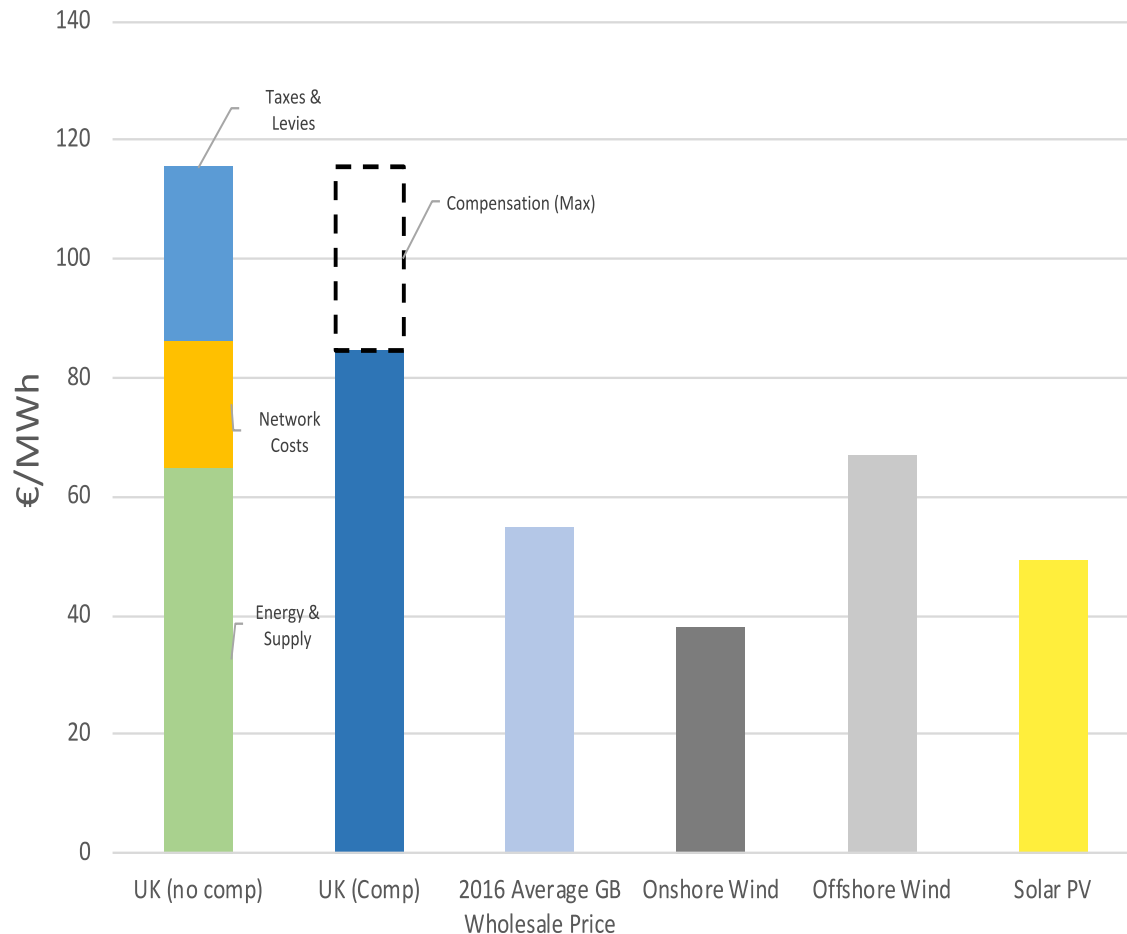
- **France: Nuclear dominates**, EDF vertically integrated generator/supplier. 'Exeltium', consortium of 27 electro-intensive companies have a 24 year contract with EDF to supply ~1/3 total consumption at a (largely) fixed rate of €42/MWh (plus network costs, taxes & levies). Other suppliers able to buy nuclear from EDF at €42/MWh.
- **Germany and UK**, price-setting marginal plants are **hard coal and CCGT**, respectively, with basic fuel costs of around €22/MWh and €30/MWh (generated) for coal and gas, respectively, in the second half of 2016, rising also with carbon price



Natural gas also marginal plant in Italy, but '**virtual interconnection**' for heavy consumers (Band IG)

Relative UK electricity market and renewables prices, 2016

Prospects ?



UK: Impact of UK carbon price will decline as coal retires, offset by collapsed exchange rate (gas imports) and rising EU ETS price

Continental wholesale costs:

ageing nuclear fleet (life extension / decommissioning; cost data in report)

emission regulations & rising carbon prices impact coal
Some convergence of coal and gas prices ??

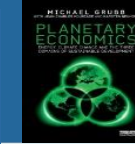
.. While Renewables costs fallen sharply

Both PV and wind, onshore and offshore ... along with batteries and continuing progress in transmission, control and demand flexibility

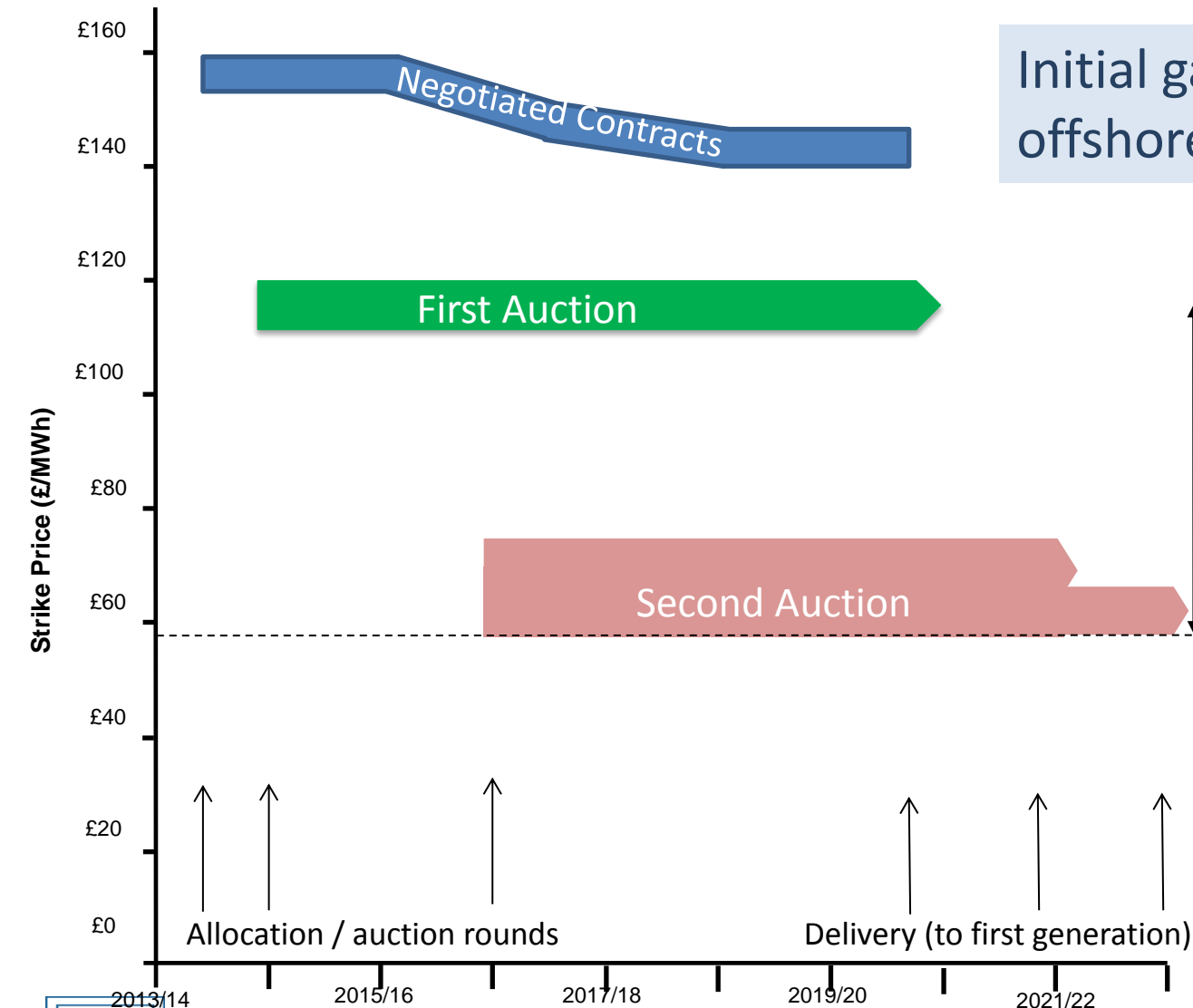
- to prices below UK industrial and (onshore wind) even wholesale elec prices



Competition in long-term contracts: Major cost savings including for UK Offshore wind



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Initial gain from auctions followed by huge progress in offshore wind, reducing costs towards wholesale price

--> UK retail electricity prices

--> UK industrial electricity prices (w/o C price compensation)

Mid 2014, administered CfD prices, £140-£150 /MWh*
Jan 2015, first auction, offshore wind price: £114.39/MWh
→ A “natural experiment ... suggesting a 3% point saving in WACC from competitive long term contracts – *saving > £2bn/yr on estimated cost of energy transition*). (Newbery 2015); Grubb and Newbery 2018)

2017, second auction, two projects at £57.50/MWh
→ **Competitive CfDs drive down cost – hardware, supply chain & finance**

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#1 Restore an efficient investment framework for the cheapest mature renewables and signal intent to restore a rising carbon price in the 2020s

- A full scale review of policy towards onshore renewables, recognising that onshore wind no longer requires subsidy if
 - political risk minimised
 - confidence in realising full value of fuel (inc carbon) savings
- Eg.
 - “Pot 1” CfD auction (maybe amended)
 - reform of planning regulations,
 - legislated carbon price escalator (with appropriate compensation mechanism) to take effect as coal is retired from the system (& see #6)

#2 Establish an integrated approach to network development, funding and pricing

- Enhanced System Operator Objective(s) to include more coordinated oversight of future generation and network developments at all scales of the system, so as to minimise combined network and congestion costs;
- consider using carbon price revenues to help fund specifically identified Strategic Wider Works
- review transmission funding and charging approaches in light of continental practice



#4 Facilitate cross-border electricity contracting incorporating national carbon prices (where are differences)

- Establish a new structure for direct cross-border industrial electricity purchases,
- With UK carbon-added price charged on purchased electricity, on same principles as the Californian CO2 cap-and-trade system

#6 Establish a long-term, zero carbon electricity contracts market

- Foster standardised structures of long-term, tradeable zero-carbon electricity contracts available to business consumers and grounded in the declining cost of unsubsidised renewable electricity sources. Consumers holding these contracts would thereby avoid the carbon price.
- Balancing and backup costs will be minimised if the renewable energy contracts are aggregated through a 'green power pool', which passes these costs on to the renewable generators
- Consumers offering demand flexibility and other system services benefit from lower contract prices.



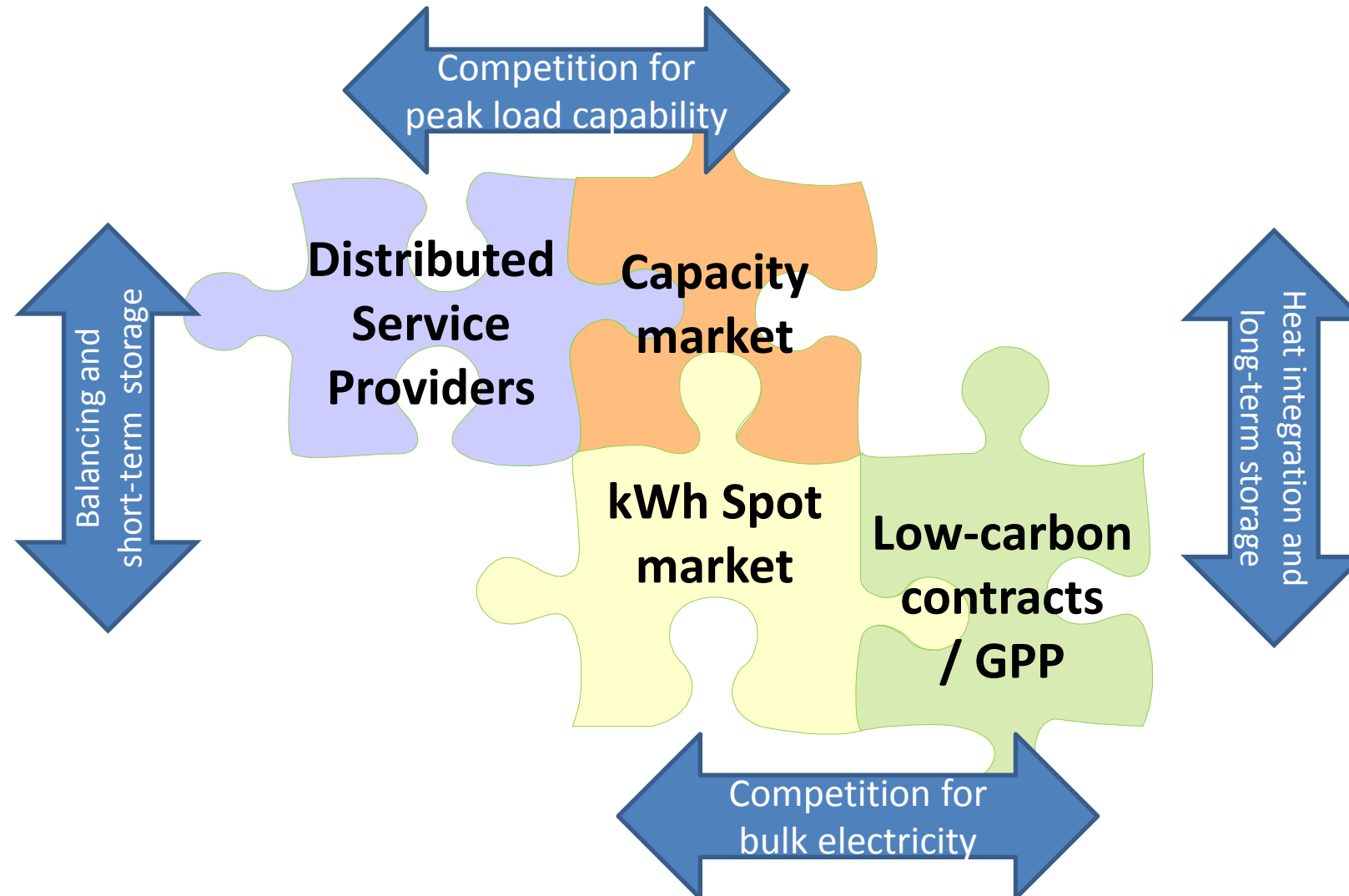
A 'Green power pool' – some key questions

- Can it evolve naturally?
 - Legally, yes
 - assuming that bundling of contacts is not considered an abuse of market power
 - In practice, probably not
 - Even contract innovators admit they have no practical way to aggregate contracts for either business customers or balancing services: classic coordination failure
- Does it require the state to legislate for a mandatory Green Power Pool?
 - Not necessarily: that would carry significant risks
- Is there an alternative?
 - May be possible to evolve a Green Power Pool with government contractual templates and (probably) some initial underwriting



... 'facilitated evolution' ?

Future system could involve multiple markets
(- *with managed competition between them?*)



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