Response to consultation on Review of Electricity Market Arrangements

Marketing Britain's Renewable Energy

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This is my response as an individual to the consultation document entitled *Review of Electricity Market Arrangements* ("REMA"), issued on 18 July 2022 by the Department for Business, Energy and Industrial Strategy ("BEIS").

My submission adopts a perspective which may differ from that of most electricity 'insiders' because it reflects the experience of other high-technology industries with revolutionary products and changing consumer behaviour. This experience is relevant to REMA's debate over whether there should be a new wholesale electricity market for intermittent energy, separate from the existing wholesale market for firm energy. This submission explains why the answer to REMA's "Question 14: Do you agree that we should continue to consider a split wholesale market?" should be "No, because a trading platform would not attract investors in intermittent generation".

REMA uses the terms "as available" and "on demand" energy; to avoid repetitive quotation marks I refer to these as intermittent energy and firm energy.

Background and recommendation

The wholesale electricity market in Britain today uses a bidding mechanism that automatically matches demand from local distributors with supply from generators in near real time. It therefore resembles a 'spot market', and dates from when fossil-fuelled generators produced most electricity. Generators which could produce additional energy at lower marginal cost received bids up to the limit of their capacity; higher marginal-cost energy producers received bids when cheaper capacity was exhausted. The market therefore automatically set the "clearing" price for a mix of generators differing in operating costs. It ensured the continual renewal of the generation fleet by encouraging the entry of new generators with lower operating costs and the retirement of older less efficient plant.

The emergence of nuclear, wind, and solar-powered generators disrupted the automatic price-setting mechanism because their marginal operating costs were very low or negligible while their fixed costs were very high. A spot market which trades marginal capacity is incapable of setting prices among generators some of which incur nearly all of their costs years in advance. The Government therefore guarantees fixed prices for these high-fixed-costs generators, through the competitive auction of Contracts for Difference (CfD).

Wind and solar generators have an additional disadvantage in this trading arrangement because the only product that can be traded there is firm continuous energy and their output is variable depending on weather. They therefore have to purchase 'flexible' (fast start-up) backup capacity and incorporate it into their offering.

The REMA consultation document, in conjunction with BEIS modelling of the electricity market from 2019 out to 2050, identifies a number of key challenges facing the wholesale market in the future. After a successful decade in deploying renewables, the pace of installation and private investment must increase. BEIS models show that in a scenario where fossil fuel costs are high, generating

capacity must increase one third by 2035 if the goal of decarbonising the power industry by that date is to be achieved. Renewable capacity must increase much faster, with most of the increase being in offshore wind which is more productive but at the same time more capital-intensive.

As the share of intermittent generation increases, prices realised in the current wholesale trading exchange will become more volatile, falling precipitately and sometimes turning negative when wind and solar exceed demand. The cost of flexible backup will increase if the peak-to-average ratio of demand increases as predicted. These uncertainties will concern potential investors when assessing risk, and may jeopardise the Government's targets for private investment.

As a possible solution, REMA has identified two alternative structures for a separate wholesale market for intermittent energy both of which involve management by a centralised system operator, as at present, and differing from each other in the extent of the system operator's responsibilities. Each assumes that generators will sell intermittent energy at prices based on long run marginal cost (i.e. including the cost of building the generation plant).

It is a natural reaction to try to improve a trading mechanism that is so obviously defective. But I submit that to adapt and improve the current automated bid-matching system would be to solve yesterday's problem. It would prevent us from confronting the most important challenge of today, which is how to convince the private sector to invest heavily in developing the market for new products based on intermittent electrical energy.

My recommendation in answer to Question 14 is therefore "No, BEIS should <u>not</u> continue to consider a split wholesale trading arrangement; instead, prices for intermittent power must be set by supply and demand." The paragraphs below summarise and then expand in detail the reasoning behind this recommendation:

- Industrial and commercial wholesale consumers will prefer Power Purchase Agreements
- Intermittent energy is not a uniform good to be traded as a commodity
- Market pricing is best for new products which will change consumer behaviour.

1. Industrial/commercial consumers will prefer Power Purchase Agreements

Unforeseen industrial uses for intermittent electrical power will emerge, particularly when capacity becomes available that is surplus to predicted firm energy demand. Temporary surplus generating capacity is an inevitable result of intermittent generation. BEIS modelling shows that by 2035 there will be surplus wind generation capacity for about 50% of the time, and the surplus will exceed 25 GW for 10% of the year. By 2050 the surplus will be in the dozens of GW for half the year. Because this surplus results from seasonal weather patterns rather than from fluctuations in demand, it will often persist for days on end. Non-traditional electro-intensive industries such as indoor agriculture (using high-intensity LEDs to drive photosynthesis) will become viable. New manufacturing industries that can use intermittent production (typically automated factories that can be supervised remotely) will flourish. These activities may make it less necessary to rely on green hydrogen for power: instead of storing power via an inefficient process it can be used to create value immediately. In any case, the efficiency of a zero-carbon 'Power-to-gas-to-power' process is unlikely be high enough to justify industrial deployment for some years to come.

The carbon-free pedigree of intermittent capacity will expand Britain's export opportunities. Britain, the EU, and other countries will have a carbon-pricing regime covering many of their domestic industries. A Carbon Border Adjustment Mechanism (import tariff) will be employed that puts imports on equal footing with domestically-produced goods of the same carbon footprint.

Domestically-produced goods that have a *lower* carbon footprint will be at an advantage. This could address a common criticism of Britain's Net Zero goal: that it seeks to reduce *domestic* emissions only and some of the reduction has been realised by abandoning manufacture and importing from countries that create more emissions than Britain did, thus aggravating global warming. An early decarbonisation of Britain's power sector holds out the prospect of 'reshoring' selected manufacturing capacity, for additional economic growth.

As REMA notes, industrial and commercial users of intermittent energy already negotiate directly with generators through long-term Power Purchase Agreements, and there is no obvious role for a separate trading exchange in setting prices for this market segment.

2. Intermittent energy is not a uniform good to be traded as a commodity

Firm energy resembles a commodity and can therefore be traded on a spot market as today. Intermittent energy is not a commodity. It will come in several varieties, differing in such things as degree of reliability and seasonality (solar most plentiful in summer daytime, wind in winter). Although these different products could theoretically be 'blended' to create a tradeable commodity, it might cannibalise revenues in the firm energy market, especially where household use is concerned. If consumers were able to use cheap intermittent power for all their needs, only switching to firm power when it was not available, problems might arise with government support for the latter. A homogenised intermittent energy would also fail to take advantage of the different patterns of intermittency and short-run marginal cost.

Possible household applications for intermittent power include EV charging and domestic heating. EV charging follows a daily cycle which may fit poorly with the seasonal patterns of surplus capacity. Given that surplus wind-generating capacity will be more plentiful in winter, domestic heating would be a more likely high-volume market. For illustrative purposes, the 100 TWh of surplus intermittent generating capacity which would (per BEIS modelling) be left on the table in 2035 equates to nearly a quarter of the energy used today for domestic space and water heating, mostly provided by gas. In summer, pool heating would be a possible volume market for surplus solar capacity.

There are more speculative future household uses for intermittent energy, which could include high-powered computing, virtual reality, gaming and movie rendering. Some of these could be 'cottage industries' or the result of a shift to 'work from home'. It is impossible to extrapolate demand for such things from today's consumption, because it depends on lifestyle changes. If significant household demand for intermittent energy is to materialise, consumer behaviour must change. The logical way to change behaviour is to rely on the consumer electronics industry to play a partnership role in creating new products which add value to intermittent power.

It was the consumer electronics industry that caused the telecommunications services boom of the 1990s. That highly competitive industry created new traffic for a modernised but still monopolistic telecom infrastructure. It was not the telecoms network operators who developed the internet search engine or the smartphone. It was Silicon Valley and venture capital. This combination proved adept at training consumers to change their behaviour to fit with innovative hardware, software and services. The same combination will develop innovative 'customer premises equipment' for tomorrow's power industry and market it in conjunction with energy in the same way that mobile phone providers sell airtime. Suppliers of communicative, bidirectionally charging EVs and heat and battery storage devices will be among those competing to sell 'Value added' services built on intermittent power.

3. Market pricing is best for new products which will change consumer behaviour.

A recognised shortcoming of today's wholesale electricity trading mechanism is that it fails to set prices of renewables based on their long-run marginal costs. This does not mean that generators using better wholesaling arrangements will set prices based on their long-run marginal costs. It would be unfortunate if the REMA consultation document were to create the impression that renewable generators would normally set their prices that way.

Operators who have surplus capacity and negligible short-run marginal costs have a remarkable degree of freedom when setting prices for new products and services, regardless of their long-run marginal costs. They can use revenues from established and profitable products to cross-subsidise more innovative products that require product development and marketing to educate users or to gain market share. Products can make a different 'contribution to fixed costs' depending on their positions in the product life-cycle. It is this flexibility that will enable renewable investors and their equipment partners to balance supply and demand in a competitive market.

In the early development of the market for new intermittent energy products and services it can be supposed that transmission capacity will be provided 'as available' at minimal cost. Firm energy will have priority and network congestion will be one of the causes of intermittency. The lack of reliability should not impede early adoption by some customer groups. This has been the the case with cellular telephony where coverage is always patchy for the most recent improvements in bandwidth.

To target the household consumer market for 'bundled' power and equipment, large intermittent generators will prefer to enter contracts with local distributors and equipment suppliers instead of trading raw power on an exchange as the suppliers of firm power do today. Of course this does not prevent them from also competing in the firm power market, with appropriate backup, as they do already.

In conclusion, a separate wholesale trading market is unlikely to be of interest to prospective investors in high-capacity intermittent energy generation. BEIS should focus on creating an environment supportive of vertical integration between generators, distributors, and innovative equipment suppliers.

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