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National Infrastructure Commission
1 Horse Guards Road
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Dear Lord Adonis,

Please see below the **Tempus Energy Supply Ltd.** response to the National Infrastructure Commission's call for evidence.

**About Tempus Energy**

Tempus Energy ('Tempus') is a technology company and an innovative, new electricity retail supplier. Tempus was established to make energy systems more efficient through capturing the value of under-utilised assets using demand-side flexibility technology. Tempus has developed technology to shift real-time consumption patterns to optimise trading on the electricity market within each half-hour, leading to cheaper electricity prices for the company and its customers, while also helping to balance the overall electricity system. Importantly Tempus is demonstrating that through the use of demand-flexibility in liquid, transparent and competitive wholesale markets, where prices reflect actual scarcity and network stress, we can create a market-based approach to integrating more intermittent renewable energy onto the grid and therefore combat climate change through market-based solutions**.**

**4. Electricity Interconnection and storage.**

1. **What changes may need to be made to the electricity market to ensure that supply and demand are balanced, whilst minimising cost to consumers, over the long-term?**

Achieving security of supply whilst minimising costs to consumers requires a paradigm shift in how we view and use the electricity system. The need to decarbonise the system, and the introduction of intermittent renewable generation technologies in particular creates new risks and opportunities. Our current system is not fit for purpose in a new world of smart infrastructure design, it does not mitigate those risks and maximise the opportunities.

A low-cost, flexible, and intermittent supply side requires a smart, flexible demand side. In order for decarbonisation and security of energy supply to be delivered in a manner that does not see energy costs spiral out of control, we need to find new ways of managing system imbalance. In essence demand flexibility is a way of managing imbalance risk by moving demand away from peak times into cheaper

price periods where renewable generation is plentiful and prices are therefore lower. Building a flexible demand side which is able to utilise off-peak surplus renewable generation on the system also ensures better value for money for customers, and reduces the cost of capital for renewable generators. This allows us to make the most of our existing renewable generation and network infrastructure.

The alternative is to build a new fleet of fossil fuel peaking plant, which sits idle until called upon to balance the system when renewables are not generating and demand is high, which in reality will occur for limited periods. The latter option also requires continuous building out of transmission and distribution infrastructure to avoid grid constraints, at vast cost to consumers. This is more expensive, carbon intensive and inefficient.

The grid infrastructure needs to be built out to peak demand. Building generation, transmission and distribution to a peak that is occasionally reached without taking any measures to manage that peak means that we are paying for assets that are under-used for the majority of the time. By incentivising energy intensive users and network system operators to employ peak time load reduction, it is possible to address the energy 'trilemma' of decarbonisation, value for money and security of supply.

Those who are able to provide demand side services must be enabled to receive the value they are creating across the supply chain through both the wholesale and balancing markets. In order to achieve this it is imperative the customers are able to access Capacity market contracts on equal terms to incentivise this equal change, and get a fair deal. These markets must be transparent, open and liquid. The vertical integration of the largest market players means that the vast majority of power is traded through bi-lateral contracts. In order to create a liquid, competitive market that would ensure true cost-reflectivity that allows the value of demand-side to be unlocked, Tempus would be in favour of measures establishing everything over a megawatt to be traded on an open market. Once a level playing field has been established that allows the demand side to compete with generation for access to such a market, a secure, cleaner and cheaper energy system will be achievable.

**1.1 Is there a need for an independent system operator (SO)? How could the incentives faced by the SO be set to minimise long-run balancing costs?**

The GB energy market faces several barriers to become a fully competitive system that sparks the innovation that will bring costs across the supply chain down while maintaining security of supply and enabling the transition to a low-carbon system. Among the barriers to creating a more efficient and customer-centric market is the current bundling of both supplier and generators, an issue that Tempus believes is more pressing than that proposed.

However, Tempus would indeed be supportive of a move to create a truly independent system operator (SO) that does not own any of the transmission lines in order to avoid conflicts of interest. An ISO, as established in markets elsewhere such as PJM in the USA, will never be in a position to favour generation over demand to balance the system nor to favour investing in building up its asset base to

keep receiving a regulated rate of return. Instead, the ISO will always be incentivised to balance the system at the lowest cost to consumers without over-investing in energy infrastructure.

The Federal Energy Regulatory Commission, in establishing ISO's under Orders 888/889 stated that an '*unbundled electric transmission service will be the centerpiece of a freely traded commodity market in which wholesale customers can shop for competitively-priced power*'. Arising over concerns around access to transmission, the Orders, established in 1997 recognised the inherent conflict of interest that occur when a system operator owns transmission assets.[1]

Any move to establish an ISO would have to ensure that that entity took Elexon and the responsibility for balancing the system with it, in order for the above to be realised. Moreover, OFGEM must set and enforce targets for the SO to meet in relation to the economical balancing of the system. A further detail that requires consideration is the relationship between an ISO and distribution networks. As the energy system becomes more localised, there will be a need for local network management solutions. An ISO must not neglect or distort this development, nor the innovation that will arise from it.

**1.2 Is there a need to further reform the "balancing market" and which market participants are responsible for imbalances?**

In order to reduce costs to consumers over the long term, the ultimate goal must be to move ever closer to a market that balances itself hence minimising the role of the balancing market and completely avoiding the need for a capacity market.

Currently market signals insufficiently incentivise suppliers and generators to manage imbalance, with costs incurred by suppliers smeared on to customers' bills. Tempus welcomes the recent cash-out reforms that have gone some way to improving cost-reflectivity, but more must be done to ensure suppliers operate more efficiently and customers don't bear costs for inactivity on the suppliers behalf.

If suppliers and generators are incentivised to be balanced or alternatively penalised not to be out of balance, this will drive these players to invest in technology to keep themselves balanced, thus reducing the need for balancing and capacity markets. This capability would predominantly be delivered by half-hourly settlement ('HHS') meters capable of being read in real-time, and flexibility assets that can quickly ramp up or down, to ensure the system is balanced in each settlement period. This would ensure more efficient utilisation of our existing assets, and ultimately reduce the need to invest in expensive generating units, and indeed networks. Investing in both at vast expense, before efficiently utilising our existing assets does not reflect a sensible use of taxpayer's money.

The rollout of smart-meters will facilitate this transition universally but in the immediate term simply allowing demand side technologies to compete on a level playing field in the balancing market, be it

[1] Order No. 888, Federal Energy Regulatory Commission, Part 1, pg.11, 1997 (Link)

through balancing mechanisms or the capacity market will have a profound effect on how we are able to operate the system in the most cost-effective way. In order for this to be realised, the SO must improve their dispatch technologies. The current manual dispatch of demand side, opposed to the semi-automated dispatch of generation volumes would distinctly disadvantage demand side capacity.

Cost-reflectivity is key. The Capacity Market methodology is not cost-reflective and is therefore a missed opportunity in this regard. Smaller customers are not rewarded for avoiding peak times and hence the incentive to shift critical demand peaks (and therefore balance the system at peak times) is compromised. Any measures taken must also take a long-term, holistic approach acknowledging the cultural and business changes needed to unlock a flexible, low-carbon and cost-reflective demand side.

**1.3 To what extent can demand-side management measures and embedded generation be used to increase the flexibility of the electricity system?**

Demand side management measures can be used to increase the flexibility of the electricity system immensely. In the PJM market, a market with three times the electricity demand of the UK, 15GW or 9% of the total capacity in 2015-16 will be provided by DSR.[2] This capacity is inherently more flexible than generating units, and is more suited to being utilised in a dynamic way to address system stress and locational congestion. It makes economic sense to make full use of our existing assets before we invest in reinforcements, ultimately at the cost to consumers. Studies undertaken in the USA have found the average cost of 'negawatts', that being watts saved were £30/MWh, representing a massive saving from for example, a CCGT plant costing approximately £76 per MWh (LCOE).[3]

As previously discussed, demand side measures also reduce the need to invest in distribution and transmission infrastructure, at the expense of taxpayers money. In New England, 'negawatts' and DSR have proved so reliable that $260 million in grid upgrades were avoided.[4]

It is worth noting that it is important when unlocking this vast value, not to incentivise the 'wrong' kind of embedded generation. Diesel units, whilst being heavily pollutive also emit fumes that are now recognised as carcinogenic.[5] Any regime must be designed to minimise the uptake by diesel generating units and farms of the scale evidenced in the Capacity market. Any restrictive criteria that are applied need to apply on both sides of the meter (i.e. both generators and demand side capacity).

[2] 'Getting more from less: realising the potential of negawatts in the UK electricity market', Green Alliance, A. Mount & D. Benton, Oct.2015.
[3] Ibid.
[4] Ibid.
[5] '*Diesel engine exhaust carcinogenic*', International agency for research on Cancer, World Health Organisation, 12 June 2012, Press release No.213. (Link)

2. **What are the barriers to the deployment of energy storage capacity?**

**2.1 Are there specific market failures/barriers that prevent investment in energy storage that are not faced by other 'balancing' technologies? How might these be overcome?**

The development of energy storage capacity would be advanced by the formulation of an appropriate National Grid product in which storage could participate. Despite being currently able to participate in the frequency response services, the market proposition does not sufficiently support the investment required in energy storage devices. Energy storage capacity also face similar barriers faced by the demand side in the Capacity market. The products available to the market need to be genuinely technology neutral taking into account emerging sectors rather than using inherently generator-centric parameters that favour incumbents over innovative new market entrants.

The deployment of energy storage capacity could be accelerated through making the energy market more cost reflective, allowing storage and other flexibility assets to play a role in allowing end users to avoid expensive peak prices. This would greatly increase their value, therefore making them more viable.

**2.2 What is the most appropriate scale for future energy storage technologies in the UK? (i.e. transmission network scale, the distributed network or the domestic scale.)**

It is most important to facilitate a level playing field for energy storage to compete, allowing innovative technologies to compete to provide the most value at different stages of the system, rather than picking winners in advance.

More coordination is certainly needed between National Grid and DNOs especially since batteries need to be connected to the distribution network but ultimately provide a service to National Grid.

**3. What level of electricity interconnection is likely to be in the best interests of consumers?**

**3.1 Is there a case for building interconnection out to a greater capacity or more rapidly than the current 'cap and floor' regime would allow beyond 2020? If so, why do you think the current arrangements are not sufficient to incentivise this investment?**

**3.2 Are there specific market failures/barriers that prevent investment in electricity interconnection that are not faced by other 'balancing' technologies? How might these be overcome?**

Before considering what level of electricity interconnection is in the best interests of consumers, we should first ensure that we are using our existing assets to the maximum capability, before we invest in new assets be they generation or interconnectors at the expense of taxpayers money. As previously

mentioned, a fully functioning demand side would dramatically improve our ability to do so. At the moment, valuable renewable generation is being thrown away at times of low demand, we should utilise this power before expecting consumers to pay for building new infrastructure.

In the event that further capacity is required, Tempus is of the opinion that interconnection is of more benefit than subsiding traditional generating units that are subsequently stranded assets. Interconnection increases liquidity into the wholesale market and can help security of supply efficiently. If our neighbours have spare capacity, it is much more efficient to use that rather than build more power stations just for peak demand. Being physically coupled with continental market is of benefit, and Interconnection along with demand flexibility should play a big part in meeting GB's capacity needs.

Interconnection requires a big up front capital expense so needs so far as possible, long-term regulatory certainty to be successful. If the current cap & floor regime does not provide the necessary investment certainty then it may need re-visiting.

**4. What can the UK learn from international best practice in terms of dealing with changes in energy technology when planning to balance supply and demand?**

We cannot predict how technological advancements will alter the landscape of our energy system. Rather than hedging bets when new technologies are in their infancy, we should ensure a level playing field that allows new technologies to come forward and compete with the status quo. What is required is regulatory flexibility that allows the uptake of technologies that, in a technology neutral market, have proved their value. Innovation does not happen in a vacuum and we must ensure that our energy system and regulation is not so rigid so as to only protect the status quo.

Yours sincerely,

Sara Bell

CEO Tempus Energy Supply Ltd.