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Thursday 12th January 2017

Smart Energy team (BEIS)

Flexibility Team (Ofgem)

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flexibility@ofgem.gov.uk

Dear Smart Energy Team @BEIS and Flexibility Team @Ofgem:

REF: A SMART, FLEXIBLE ENERGY SYSTEM - A call for evidence

I have read the documents in regarding the call for evidence for A SMART, FLEXIBLE ENERGY SYSTEM.

The call is very interesting, timely and welcomed but I am very disappointed that the call did not address the fundamental and strategic issues rather than some very trivial secondary issues through the document. Therefore I have decided to raise concerns about the arguments put forward by the document and also point out what are the fundamental and strategic issues that should really be addressed very urgently.

What do Smart Meters play in the transforming the energy systems?

In the document, it says that “for instance, the Government is committed to rolling out around 53 million smart meters (together with the supporting infrastructure) by the end of 2020. Smart metering on this scale will provide the backbone of a transformed energy system in which we can produce and consume energy more



flexibly and efficiently than ever before.” It looks that the role of smart meters has been overstated. It is well known that **Smart Meters** are just electronic meters and they could not do the controls! **Without suitable control systems in place, demand side management could not be fully implemented with Smart Meters** alone. Hence Smart Meters are just entry level requirements while control systems are really the key to make the smart demand management possible.

The age of exclusive control by big energy companies and central government is over. Is this going to be true?

In the call, it says that “The age of exclusive control by big energy companies and central government is over; we must maximise the ability of consumers to play an active role in managing their energy needs. With a smart system we can go further and faster in breaking down barriers to competition – allowing the widest possible range of innovative products and services to prove themselves in the market place.” I would like to point out that transporting of electricity is quite different of that of apples while the former is different from the later in terms of security and reliability of delivery on seconds by seconds. Without thinking strategically, relying largely on consumers with smart scale energy provisions would bring long term security and reliability problems. While introducing consumers to play an active role in managing their energy needs, in some situations, it would bring benefits economically but in some other situations, fast responsive demand reactions of consumers would collectively bring security constraints to system power flows, voltages and frequency **much more quickly** than traditional demand reactions. **This means that consumers could either play a positive role or a negative role depending on the timing and locations they play and the market mechanism being deployed. It seems that the argument in the call is too positive about consumers’ role while forgetting the potential risks introduced by the play of consumers.**

Does a smarter and more flexible system offers significant benefits for consumers and the economy?

In the call, it says that “Government and Ofgem are committed to ensuring the energy system works for people and businesses. A smarter and more flexible system offers significant benefits for consumers and the economy. This can help to ensure the UK has a secure, affordable and clean energy system now and in the future, while helping to enable growth in all parts of the country.” In general, “A smarter and more flexible system offers significant benefits for consumers and the economy.” would be true. **However, the potential risk is that with largely relying on smarter and more flexible system offers, people would make the transmission and distribution networks operated towards their physical security limits along with the complexity of operations and market arrangements. Hence such systems would be more vulnerable than traditional systems in some situations.**



How energy storage services are provided? And who should be the providers?

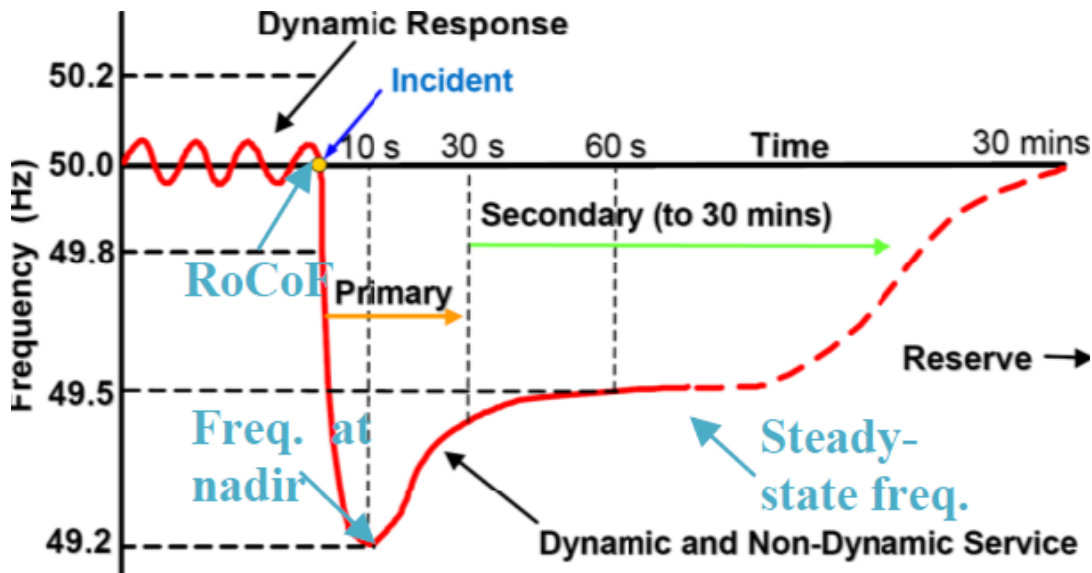


Figure 1: System frequency evolution after a contingency (National Grid)

Energy storage devices could be used in the UK energy systems for different purposes as shown in Figure 1: (a) provision of **primary frequency response and stability /power flow/voltage control** in the time scale up to 30s; (b) provision of **secondary frequency response and power flow/voltage controls** up to minute; (b) provision of **active power reserve** at the time scale of hours.

These different applications will need different types of energy storage systems and hence different ownerships. For the provision of **primary frequency response and fast stability/power flow/voltage control**, **transmission system owners should be allowed to have licenses to install and operate suitable energy storage systems so that such fast provision of energy storage services can be secured in order to ensure a reliable, flexible and smart energy systems while without jeopardizing the system security at national level. This consideration** is based on the facts:

- In the real-time control and operation of power grids, there needs to a large amount of operational status information flowing between the energy storage systems and the transmission owners. Ownership of some fast energy storage devices would provide robust, secure and **seamless interface** with the rest of transmission equipment while providing very timely fast frequency and stability/power flow/voltage control services on the time scale of seconds.



- In terms of emergency, if we rely on the provision of **primary frequency response and fast stability/power flow/voltage control** by 3rd parties, reliable information flows between the energy storage providers and the transmission owners cannot be guaranteed. In addition, potential risks of insecurity due to cybersecurity issues would be much higher than that of fast energy storage provision by transmission owners.

On the other hand, 3rd party providers are most welcome to provide active power reserve services and market arbitrage, shifting peak demands as these services become less time critical.

“The electrification of transport and heat will have significant implications for patterns and levels of power demand locally and nationally.” Is this true?

This argument is well accepted but the question is whether suitable measures and policies are/or will be in place in timely manner. This argument means that electricity networks will play much larger roles than that before. **Leaderships at National level and Regional levels around large cities to derive the agenda of electrification of transport and heat should be ensured.**

Balance between long term and short term objectives

Having gone through the call, the impression is that arguments are largely associated with short term objectives. Quite often short term focused solutions may cost more than long term ones. Hence such an issue should be realised when making energy policies.

The GB energy system needs technologies and infrastructure that are both cheap and clean, but it also needs innovation in processes, transactions and customer offerings. Is this true?

In the call, it says that “**We want to encourage innovation.** A key role for Government and Ofgem is to create the environment for new ideas to flourish by removing barriers to innovation. The GB energy system needs technologies and infrastructure that are both cheap and clean, but it also needs innovation in processes, transactions and customer offerings. Consumers will benefit most from an energy system and markets that can match the system need with the most cost-effective solution, in both the short and the long-term. This may require innovation in existing markets, or via new market platforms for trading and commissioning flexibility to allow value to flow through to providers of flexibility.” In particular the argument “**The GB energy system needs technologies and infrastructure that are both cheap and clean**” is not necessarily true. It may be the case that **actually the GB energy system needs technologies and infrastructure that are able to transform the energy systems towards**



secure and sustainable energy systems to enable renewable energy integration, reduce CO₂ emissions and create new job opportunities while bringing innovative services with added values. A good example is Apple's i-Phone. Do you believe that I-phone is cheap?

Also I would like to mention our visions and concepts, proposed by us from several years ago, on:

- (a) **Energy Union:** It is fascinating that European Commission established 1st even Energy Union in the World to address the energy governance challenges based on our proposal, which sets up a good direction and example in the World. The EU (means Energy Union here) would still be possible to open up a door to the UK to access the European Energy Markets despite the Brexits after March 2017. I trust we will need to investigate how to integrate our UK energy market into the rest of the EU energy market within the framework of the Energy Union. It seems that in the UK, there was very little research on this.
- (b) **Global Power & Energy Internet:** Our vision on Global Power & Energy Internet means a Global/Comprehensive Framework for Future Power & Energy Systems = Electricity + Gas + Heat/Cold + Transport + Different Forms of Energy Storage + Internet. With this framework, a lot more can be done by integrating different energy elements to achieving maximum performance and efficiency while providing operation flexibility and business opportunities, etc.

Architecture of Global Power & Energy Internet

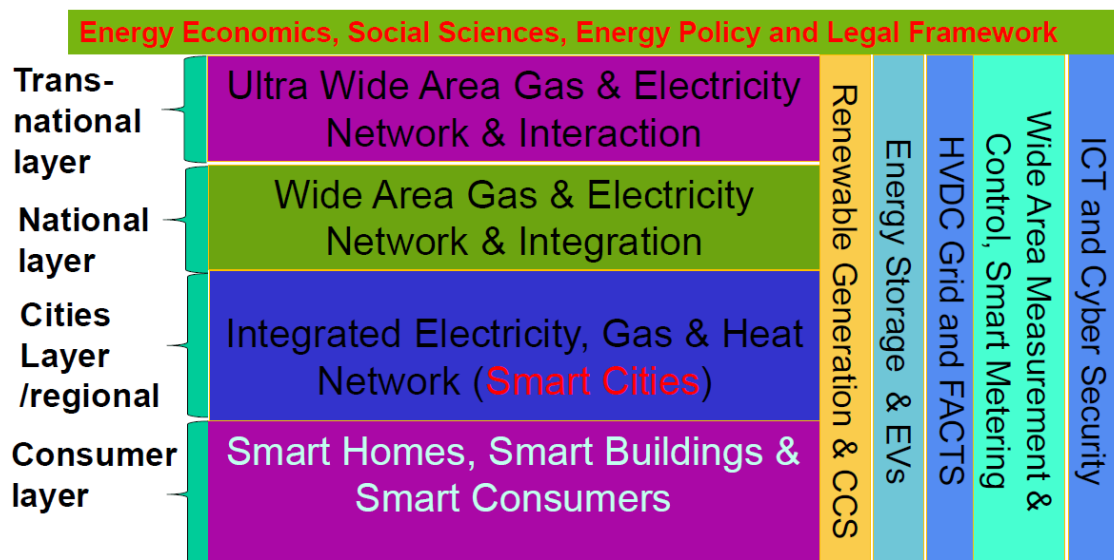


Fig. 2 Vision on Global Power & Energy Internet



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(c) **Midlands as the UK's Energy Valley:** With the launch of the Energy Capital in Birmingham on 15th Feb 2017, this vision becomes a reality!

Finally I appreciate very much the willingness of both BEIS and Ofgem to engage positively stakeholders and your excellent leaderships that you have been playing. I do hope my comments may bring different perspectives from a different angle.

Should you require any further details, please do not hesitate to contact me. In the meantime we are looking forward to welcoming you at the University of Birmingham to show you our research and Smart Grid Lab where quite some smart control ideas are operational now.

Sincerely yours,

A handwritten signature in blue ink, consisting of stylized, flowing characters.

Professor Xiao-Ping Zhang
Chair in Electrical Power Systems