Summary note – Future of Reactive Power workshop held on 11th November 2021

Draft Service Design

A key factor that the industry found worked well was around the ease of understanding the effectiveness as it enables our customers to build this into their own commercial models.

While numerous questions were raised around the provision of the service, these have been captured in the updated Q&A document.

Technology Case Studies

Questions mainly centred around how the different technology types can provide reactive power as well as where reactive power is needed most.

Next Steps

NGESO is committed to delivering answers to the questions raised as part of the workshop.

Mural board

Thank you to everyone for your contributions to the mural board both during our workshop and afterwards. They have been really helpful and will be used to help shape our work.

The following is a collation of all the information gathered on the mural board, split into the following themes:

- DNO Impact
- Effectiveness
- Losses
- MVar provision
- ORPS
- Procurement/ Contract
- Technology

Area	Comment
DNO Impact	
Service Design	Can NGESO work with the DNOs to align with any ANM schemes they have, so assets don't need to define two interfaces?
Case study	The ability of the DNO to manage the impact on their network of operating at different reactive power levels needs work. Some DNOs e.g. UKPN have been quite active in improving their visibility of the impact
Effectiveness	
Service Design	Effectiveness is easy for customers to understand and build in to own commercial models.
	In Pennine effectiveness didn't work
	Do you think of zoning the country as well as effectiveness. i.e. the two go hand in hand?

	Are the existing 'needs' (and hence effectiveness values) too centred around where the existing large synchronous generators are?
	Tool should be cost effective for despatch e.g. the new internet-based software used for STOR not full EDL
Losses	
Service Design	Post fault response could come cheaper as don't need to pay for real power losses unless the fault occurs.
Case study	Due to the inherent losses, shouldn't the ESO be factoring in the cost of the losses from distribution providers for solving transmission needs and the impact on the distribution system when considering distribution providers?
	It is essential to allow indexing to energy as losses is a key utilisation cost outside of the provider's control.
MVar Provision	
Service Design	This is all about quantifying MVar, not how it's contracted. The latter is the important aspect. Some storage etc. is naturally inertial, and therefore offers MVar provision/load (and inertia) like power stations. These need MVar and inertia contracts to be intrinsically linked to energy and balancing services contracts which are impossible to deliver without also delivering MVar and inertia. (Ditto ancillary contracts.) There will also be room for separate procurement of additional MVar provision/load if needed.
	MVar provision/load by inertial plant: they can deliver both services very quickly if spinning with other contracts; they can't if not. Links need to be made. There are so many services that naturally inertial plants provide, most of them intrinsically linked to each other (e.g. they can't provide energy without also inertia, MVar, voltage/frequency control, other stability services) that they should have the full range assessed simultaneously: it's much cheaper to buy all from a naturally inertial plant than separately from other plants - and synthetic inertia etc. are not the same due to the response times. This can be done by tendering on a matrix basis.
	It would be v easy for stations with multiple BMUs to be configured so all BMUs change their voltage setpoint at the same time - but there is no incentive for providers to do this.
	Provision of MVar etc. by batteries requires 4-6 same-sized installations to provide the same services offered by inertial storage - so why the obsession with them?
	How will NGESO communicate set points to the providers?
Case study	MVar provision by DC connected systems, e.g. batteries, require dedicated plants; if provided by naturally inertial plants e.g. pumped hydro, CAES, it's delivered concurrently with other services from the same plant and therefore much cheaper - but only with linked contracts.
	Provision of MVar power/load by inertial plants can be considered to be almost identical to providing them by power stations.
ORPS	
Service Design	Apologies if I misheard, but if it is the case that the ESO is not considering the current ORPS arrangements alongside this work then a lot of this work will be massively delayed. Without reforming ORPS we cannot introduce a new reactive market

Case study	Again, not sure why Amber as ORPS payments usage show high values for all VSC interconnectors?
Procurement/ Contract	
Service Design	Preference for co-procurement of all services incl. stability and energy (noting energy is only co-procured by ESO in balancing timeframes through BOA or trades)
	How does the ESO separate the value of static vs dynamic reactive power delivery, even though the payment for a MVARh doesn't distinguish between these capabilities?
Case study	Intermittent sources shouldn't have MVar contracts unless naturally inertial, because they cannot be relied upon to deliver them when wanted: the wind may not be blowing and the sun may not be shining. The case study only looks at them when they can deliver them, not when they can't. They may be able to produce small amount at low active power, but not at zero active power.
	Synchronous condensers are a massive waste of money: the same services can be delivered much more cheaply and without building dedicated plants by inertial storage. What's preventing it is the contracting framework: cannot link energy to MVar etc., and can't engage contracts long enough in advance to build the storage (their lead times are long, mainly due to grid connection lead times which are not in their control).
	Difficult to build a business case for a pumped storage plant - especially when no certainty over value of reactive power and inertia and fault infeed all being procured separately!
	In my experience, HVDC converters will be sized to provide 0.95pf capability at all MW power outputs by default. I imagine this could be modified to be made higher at lower MW outputs but would require a control change.
	BESS could do post fault response and inertia in parallel as 2 mutually exclusive (probably!)
	Key barrier to battery storage participating in reactive power market is the high opportunity cost of Dynamic Containment, if there was a way to stack the reactive provision with DC then this would help.
	Surprised ESO doesn't already know the reactive capability of onshore wind considering it procured a fair amount of resource in the Scottish Reactive Tender in 2019.
	Which locations need reactive power most? Is there a map?
Technology	
Service Design	Why are you so focused on what converters, i.e. DC connected systems, can do? What about naturally inertial technologies?
Case study	is the ESO technology agnostic?
	Your focus exclusively on technologies is not helpful. NG has been telling us consistently for 8 years that we can deliver exactly what they want, but for that entire period it's been disabled by the contracting framework, which is why for that same period you've had to engage in dozens of Pathfinders and projects like this one.
	Not sure why Onshore wind shown as 'amber' when it already demonstrates high reactive capability at zero MW on many sites.
	Why are shunt reactors not represented in a case study?

	How can a HVDC connected offshore wind generator provide a reactive power service, if the provision of reactive power support is delivered by the converter stations, which will be owned by an OFTO?
	Sometimes a long term solution e.g. capex for a Shunt Reactor will be more cost effective. Obviously a short term market wouldn't facilitate this as it needs investment certainty.
	Offshore is different to onshore; the long subsea cables mean it is difficult for wind turbines to provide as wide a range as onshore turbines at the onshore connection interface. HVDC connections are completely different thought - same capability as an interconnector!
	Spinning unloaded turbines is definitely something that at least some inertial storage can do.
	I think onshore WTGs can do more than is required currently by codes. it needs the turbines on. it is probably possible to run the turbines at no load consuming real power but providing MVArs. So commercially a potential untapped resource.
	Offshore wind reactive for AC solutions is mostly delivered by onshore equipment and for HVDC the same, as will be the onshore end convertor.
	Do synch comps take up much space? Compared to say BESs or nuclear or PV then maybe not.