# Project Assessment Consultation Response from Cleanergi - sections 4-6

Dear sir/madam,

Please find below some input to this consultation, sections 4-6.

## Contents



## *Q7, 4.1-4.2, Impacts: Technological diversity*

It is certainly in consumers' interests to have the widest possible mix of technologies available in the market, for which reason it is in the government's, regulator's and grid's interests to support full-scale first-of-a-kind plants (FOAKs) in any way needed. For this, an attribution of value to diversity (4.2) is good.

It is similarly in their interests to have a mix of technologies rolled out across the grid. This mix must be restricted by cost, efficiency and capability. Capability itself needs to have a mix of definitions, primarily relating to (a) duration, (b) synchronicity, (c) size / grid voltage level of operation, (d) location / configuration with respect to major supply and/or demand, to grid sections and to constraints, and (e) any other factor that is important. In every category, plant life should be a factor: the longer, the better. For these, an attribution of value to diversity is beneficial but secondary to regulation and market design – see the next paragraphs.

Given these diversities, lead time should not be a consideration. The grid is as expensive, unreliable and fragile as it is because for the last 40 years it has focused on contracts which only allow short construction lead times and, due to short-duration contracts, only incentivise short-lived plants like batteries. Even they were only introduced to the grid when Ofgem created the EFR contracts, for half their amortisation life: if Ofgem wants infrastructure-scale plants, contracts need (like this cap and floor regime) to have durations of around half the plant's expected life, and lead times to delivery of the contract that allow for the funding, detailed design and construction of the plant.

With regards "(d) location / configuration with respect to major supply and/or demand", I note that if renewables are connected directly to the grid, and storage is elsewhere, then the grid needs to be reinforced to peak generation. This is why each new GW offshore wind requires (in addition to the cost of grid connection and building / operating / procuring / connecting balancing and ancillary services) £3bn onshore grid reinforcement for connections in 2030, up from £1.75bn for 2025 connections and £1.25bn for 2022 connections – thus, rising exponentially. This is plainly unaffordable and (given the nimbys' understandable opposition) politically impossible through to 2050. If connected through storage of suitable size and duration, then reinforcement only needs to be to peak demand – which is the grid's actual size, so reinforcement is only local. If that storage is synchronous, then it provides all the ancillary services too; moreover, the {renewables+storage} can be dispatched and operated as though it were a power station, greatly simplifying Control Room actions. Yet current regulations and market designs actually penalise such configurations. See Saving Billions on Grid Upgrade.

## Q7, 4.3-4.5, Impacts: Option value

All of these options are truly valuable and should be considered within the assessments. However most of the options will not have been analysed and developers would have to incur significant costs to do so, so many years ahead of developing such options. The financial justification for doing such speculative work so far ahead of need is doubtful at best, and impossible for smaller / newer developers. Therefore no such analysis should be required: just a suitable description of the relevant options, together with the developer's thoughts on benefits which are likely to be supplemented by Ofgem's own knowledge of the region.

## Q7, 4.6-4.9, Impacts: System Security and resilience

A difference must be made between real and synthetic inertia, as explained previously (sections 1-3): synthetic is good for recovering from faults, real does both that and prevents them cascading around the system in the first place. Synthetic can deliver some services at a significant energy cost; real delivers all the services at minimal energy cost and concurrently, with or without concurrent energy delivery.

## Q7, 4.10, Impacts: Flexibility

Your obsession with "flexibility" as you see it is the bane of LDES and the grid as a whole, leading to the current increasingly unaffordable, unreliable and fragile system. Every time I hear or read the word, I scream inside because it is so abused. It is based on a deliberate and oft-reinforced mis-reading of a 2012 analysis by Imperial College which stated, in a footnote: "we should stop talking about a need for storage, and instead discuss a need for flexibility and duration". This was mis-quoted ever since by omitting the words "and duration". Flexibility without duration is useless: a large supercapacitor delivers that at grid scale, for a few milliseconds. Flexibility as procured only has 0.5-2 hours duration, which means that on a windless winter night in a future renewably powered grid, it will be exhausted by 6pm, guaranteeing nationwide black-outs and over-reliance on imports through interconnectors from neighbouring countries which have the same problem concurrently with ours. Please stop ever discussing "flexibility" without "duration" in the same discussion.

And flexibility should not only refer to energy, but also to ancillary services. For a decade and a half the government, grid and regulator have discussed the grid in terms of electrical energy, as though that were all that is needed. It is not: the grid needs that energy to be time-related (flexibility and duration), and also needs all the various ancillary services for grid operability, reliability, resilience and recovery. See more here. Focusing obsessively on electrical energy is only half the challenge – and less than half the cost of running the whole system.

## *Q7, 4.11-4.12, Impacts: Need for cap and floor support*

I don't trust your "view on whether an LDES project genuinely requires C&F support to proceed, or whether it could potentially be developed on a purely merchant basis without regulatory intervention." C&F is not needed for profitability: most C&F projects are profitable, or they would not be proposed.

The only reason why C&F is needed is because financiers need some protection against commercial and regulatory risk.

- Regulations and market designs are changing increasingly fast, thereby magnifying those risks. If you had a well-designed regulatory system (e.g. defining storage as storage, based on the definition of interconnectors; not as a sub-set of generation) and market design, with suitable contracts at suitable durations and with suitable lead times to delivery of those contracts.
    - ◊ I have been proposing a simple such system for a decade, to no avail – as a result of which, you have to resort to subsidies and a C&F system which are costly and administratively burdensome for all. Such a system would cost less than today's, considered as whole-system costs over a reasonable period of time.
- Your planning is short-sighted:
    - ◊ You consider "strategic" to be 5-7 years' time, which is 1/3-1/2 grid connection lead time and therefore an operational timescale, which is up to 1 grid connection lead time (including time for planning and financing);
    - ◊ Short term planning is 1-2 lead times;
    - ◊ Medium is 2-3 lead times and
    - ◊ Long term / strategic is longer than 3 grid connection lead times;
    - ◊ Otherwise, the plans cannot lead to suitably fundamental decisions and actions.
- Your system view is too narrow. I had had hopes that creating a NESO would change that, but you seem to have adopted most of National Grid's habits of salami slicing the system.

- ◊ System and Network are divorced by regulations, meaning that any actions in one that affects the other cannot derive revenues from both, so optimal actions cannot be funded.
- ◊ Even within system operation, contracts are salami sliced which incentivises small and narrowly capable technologies and impedes large and broadly capable ones.
- ◊ A broader view, e.g. of the interaction with the grid of major users such as the hydrogen economy, data centres and decarbonising industry, is impossible, and improvements that benefit the system as a whole are prevented by adverse regulations and a lack of possible ways to remunerate them.

- ♦ Similarly, a few simple and cost-free tweaks can encourage new technologies and new small developers.

## *Q8, Factors not considered*

There is no consideration as to how different storage solutions should be compared, like for like.

The only way to achieve 2030 and 2040 targets is for all new assets to be 2050 compliant, and usable in ways that will be needed in 2050. This is because:

1. In 2040 there will be many old assets that are not 2040 compliant, so all new assets have to over-comply to balance them, i.e. 2050 compliant;
2. LDES being built now will still be there in 2050, so any that are not 2050 compliant will either be obsolete during their lifetimes or need lots of negative-emissions plants, which will be prohibitively expensive for the grid, consumers and country.

No consideration has been given in the C&F regime to Black Start, which is why our project does not include that capability which would add to costs without there being provision for increased revenue. Despite consistently concluding falsely that “more work needs to be done”, National Grid’s own Distributed Restart project (first engineering report) proved conclusively that batteries and DC connected systems cannot re-start major loads or adjacent grid sections, and there is no conceivable way in which low-voltage grid sections can re-start higher-voltage grid sections. These false conclusions mean that no work has been done on building transmission-grid-connected Black Start capability. Further analysis is here. Moreover, re-starting the grid from storage requires at least some operational capacity of that storage to be set aside, and therefore remunerated expensively for just sitting there, otherwise it may be empty when needed: ours is the only storage technology that exists that can black start the grid without having to reserve operational capacity, and therefore can deliver the service much more cheaply – but still needs some contracts and payments to do it.

## *Q9, 5.1-5.4, Financial Assessment approach*

This proposal for setting caps and floors for each project individually is good for technologies that do not have large numbers of installations and therefore have not benefitted from the cost reductions that arise naturally from technology maturity. However, for mature technologies there should be a fixed cap-and-floor, or an auction.

The last sentence applies to future windows, not to the first (or first few), because Ofgem and developers do not yet have a firm view as to the levels at which they should be set, from the viewpoint of either the system or the technology / project. Nor can we have one until we go through it a few times, as each window will refine it.

## *Q9, 5.5-5.25, Wholesale Market Arbitrage revenues*

**5.5-5.6, Arbitrage**

Most storage revenues will not be arbitrage, which does not offer enough to pay for it. Most will be value-added services. If you want arbitrage to pay for storage, you must reduce the many expensive actions you are taking to time-shift demand etc. which cannibalise those revenues.

**5.7-5.11, Re-optimisation**

Can your modelling not allow for (say) 70% accurate foresight, rather than perfect? Another problem with perfect foresight is that if all plants had it, then they would be triggered (on/off, up/down) simultaneously, overloading the grid and over-compensating in the market.

How can you calculate re-optimisation?

**5.12-5.16, Balancing Mechanism**

See comment on arbitrage re. revenue cannibalisation, and re-optimisation re. perfect foresight.

5.15 (use now foregoes future use) is much less relevant for 8-hour storage than for 0.5-2 hour storage.

5.16 revenue neutrality: if there were no revenue benefits from the balancing market, the storage would quite simply not participate in it. Therefore this assumption is false.

**5.17-5.22, Capacity Market**

5.17-18 Currently derating factors for storage only apply to duration. In future they should apply also to availability / down-time, with a default (or set of defaults per technology type) for new technologies.

5.19-21 What if the actual capacity market prices differ? Then the finances of the plant are altered based on factors outside their control.

5.21 This detailed analysis of capacity market revenues (and other revenues) by developers needs to be done at the later assessment stage, not at the eligibility stage. Otherwise you are expecting excessive financial assessment even before eligibility is granted, which will exclude many bids and many companies, especially smaller / newer companies and those with new technologies.

Moreover, asking each company to make their own Capacity Market forecasts would be enabling the market to be gamed by being either over- or under-confident about future prices. In this way, worse projects may beat better ones based on the quality of their gaming rather than their project. The same applies to many other revenue streams. Instead, each technology should list the revenue streams they can access, which are concurrent, which are obligatorily entered into because others are done (e.g. synchronous storage cannot deliver energy without delivering all the other services), and response / ramp rates, and Ofgem should calculate the rest so as to eliminate this gaming.

**5.23-5.25, Ancillary Services**
The two paragraphs on Capacity Market also apply to ancillary services.

If designed to enable it, then two-train synchronous storage should be allowed additional cap margin for operating their second train as a synchronous condenser, which would require some energy consumption. Ofgem must indicate early whether or not this will be done, so that any relevant design changes can be made.

**5.26, Cap and floor payments**
No comment.

**5.27-5.29, Investment and operating costs**
Operating costs include costs of trading the plant, e.g. manpower, guarantees.

Energy purchase prices should be set by Ofgem, or there will be another gaming opportunity.

**5.30, Financial parameters**
The cap should be "soft", which is in the guidance for the competition. That means that if operators exceed the cap, they retain a significant portion of such excess. This is necessary to keep the market operating properly; if the retained portion is too low, then operators will stop responding to market signals as they approach the cap. The more the operators respond to market signals, the better the market works in delivering the needs of the system and of consumers.

Ofgem should decree a discount rate, and zero inflation assumption in the figures, to avoid more gaming opportunities.

**5.31-5.35, Implications of the Financial Assessment**
The only way in which this can be "a consistent way to compare projects" is if Ofgem were to implement my recommendations above (and others) on measures to reduce gaming.

Another factor is cycle times. If, for example, a technology is 66.7% efficient grid-to-grid, with equal charge and discharge power ratings, then an 8-hour plant will need 12 hours to charge, leaving only 4 hours available for flexibility of operation, and for trading low-energy ancillary services. A 10-hour plant will need 15 hours to charge, totalling 25 hours a day if a full daily discharge is assumed. Assumptions of full daily discharge will be proportionately more impossible for longer duration plants. If, on the other hand, you want equal charge and discharge times, then charging will have to be a higher power rating (by the inverse of the efficiency), requiring greater plant and grid costs and grid capacity. Therefore Ofgem will need to impose assumptions as to the depth of discharge, especially for longer-duration plants which will benefit slightly from weekly arbitrage – but not benefit enough to compensate for the extra costs.

I recommend that new technologies receive SIF funding support also, in line with the consumer, system and societal benefits of having more technologies available. If SIF funding is granted, then it (after subtracting reasonable related costs) can be deducted from capital costs to the extent that they are used for developing the plant itself for the services calculated within the scheme. (Any element used for developing other capabilities or undertaking related research / analysis / modelling should not be deducted from plant capital costs.)

## *Q11, 6.1-6.19, Marginal Additional method*

The marginal addition has to be, for all proposals, the margin from today's system. It cannot include other proposals, which may never happen and which in any case would disadvantage the one being analysed versus those assumed to be in the base case.

Second-order impacts (6.18-6.19) do not consider the benefits that synchronicity can supply, especially those that grid-forming inverters cannot (or can but with substantial energy consumption). If there are any of those at all, then the technology is needed; then the question is how to provide other relevant revenue streams to supplement those from such synchronous benefits, and thereby to reduce the cost of provision of such synchronous benefits.

Your assessment of the benefits does not appear to accommodate the fact that the more revenue streams are awarded to the LDES, the less each revenue stream will cost because the LDES costs (including asset amortisation) do not increase (or only do so negligibly) and are spread / defrayed among a greater number of revenue streams, so reducing the amount of defrayal needed within each revenue stream.

## *Q12, 6.1-6.19, Counterfactual*

The counterfactuals used previously by NG and Ofgem focus on energy and not on duration or ancillary services. They therefore greatly distort the system towards batteries. The energy system needs to be able to cope with the worst reasonable case, a *kalte Dunkelflaute* and the likelihood of a follow-on similar weather pattern before the storage is replenished, i.e. add ~50%. This must be up-rated again by 10-15% for Capacity Margin in case of partial system faults / failures. This must analyse ALL the ancillary services (real inertia, not just synthetic, as the latter does not deliver all the services) for the entire period. Synthetic inertia is great for recovering from failures; as demonstrated by the recent Iberian blackouts and previous ones in the UK 9/8/19, only sufficient real inertia can prevent the failures cascading around the system in the first place. And some services (e.g. phase-locked loops) cannot be delivered by asynchronous storage, even with synthetic inertia.

Therefore the counterfactual requires the construction not only of myriad batteries with synthetic inertia, but also of synchronous condensers, grid reinforcements for all these additional plants, and grid modifications to transmit those services from one grid section to another. Without including all these additional matters, the counterfactuals will be unfairly promoted and the proposals unfairly discarded, with enormous ongoing cost increases to the system and to consumers, as we have seen for the last decade and a half.

Moreover, you state (6.4, 6.16-6.17) that the counter-factual will be provided by NG's Future Energy Scenarios (FES). These have always favoured batteries over other storage for exactly the reasons stated above. This means that they forecast excessive amounts of battery storage in the system. There is a need for battery storage, up to a point. Above that point, they cannibalise the revenue stacks of the required LDES which thereby merely adds cost without adding capacity, because to make up for that revenue stack cannibalisation the LDES must put up its prices for other services that the batteries cannot provide. This is the result of poor strategy leading to market designs that greatly incentivise such perverse outcomes as opposed to sufficient LDES – which is why no LDES has been built since its need was identified in 2012. To asses the counterfactual, unbuilt batteries should be excluded also, as should other generation that has not achieved final investment decision (FID).

The change from the previous counter-factual assessment (6.5) is good as far as it goes, but should further be amended by my comment on 6.4 (previous paragraph). Any LDES given a contract under cap and floor should be considered as equivalent to that LDES getting its FID.

## *Other Matters*

### *Black Start*

There is no room in this entire regime / scheme for Black Start, which:

- Cannot be delivered by asynchronous storage;
- Cannot be rolled up from distributed systems to higher-voltage networks; and
- Risks being needed at exactly the point when storage is discharged, in any storage technology other than CleanCAES with CleanStart.

### *Assessing the project's need for cap-and-floor*

In the consultation workshop you stated that you will try to exclude projects that would be merchant profitable. This is very wrong. Owing to their size, these projects are very expensive: not expensive per unit size, but big investments in themselves. No LDES has been built since its need was identified in 2012 because there are no contracts that can be end to with sufficient lead time, duration or comprehensiveness of cover that can be entered into prior to construction. Only this scheme delivers those three factors. Therefore even if a project is exceedingly profitable when built merchant, it will not be built without this scheme. And the problem (and hence need for cap-and-floor) is compounded if the project is also a first-of-a-kind.

### *Co-located assets with renewable generation*

(C.f. sections 6.11-6.13) If the storage is of suitable scale and duration, then building it between renewable generation and the grid will remove peaks, troughs and most intermittency, while also managing ramp rates. This means that the grid to which it is connected will not need to be reinforced to peak generation, but instead to peak demand. But it is already scaled to peak demand, so it makes all grid reinforcement local. For renewables without such storage, he cost of such grid reinforcement (excluding the cost of the grid connection itself) is £3bn/GW of offshore wind being connected in 2030, growing fast: that figure is £1.75bn/GW for connections this year and £1.25bn for 2022 connections. The costs of this are why the last offshore wind CfD round failed, and why Hornsea 4 was cancelled.

To this needs to be added the costs of building, connecting to the grid, and ongoing procurement of suitable-scaled stand-alone storage. And if the co-located storage is synchronous, benefits include avoidance of need to connect, build and procure ancillary services. Despite all these benefits, co-located projects are actually penalised, because renewable generation CfDs and contract payments are payable on MWh delivered to the grid, which are reduced by the storage. So while the quantity of electricity developed to the grid is reduced somewhat, its quality is increased enormously.

The benefits of such co-location are enormous, yet the regulatory and market disincentives for it are equally large. Moreover, the configuration cannot legally be incentivised for the benefits to both system operation and the grid infrastructure: it is one or the other, and the latter (benefits to grid infrastructure) are both immensely difficult and inadequate in the ways in which it is currently assessed. The solution to this would be to change the regulatory and market disincentives, rather than to amend the cap-and-floor regime; however if the disincentives are not turned into incentives, the cap-and-floor regime must be used in a significantly modified way.

### *Requiring LDES to provide annual availability information*

LDES availability data need to be considered very carefully. It is unlike interconnectors in that their availability is dictated only by technical up-time and down-time. This same measure would be good. Therefore down-time needs to exclude time for which the storage is technically available but exhausted. Being in that state (technically available but exhausted) means that the storage is MORE, not less, useful to the system as a whole and therefore consumers: it has been dispatched to exhaustion, whereas others have not.

Yours,

[redacted]
Founder, Cleanergi
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