Grid-scale energy storage and integration
enabling renewables to power the world
affordably, reliably and resiliently

Project Assessment Consultation Response from Cleanergi - sections 1-3

Dear sir/madam,

Please find below some input to this consultation, sections 1-3. If I get time, I will respond to the second half of the consultation paper too.

Contents

Planning and grid connection

Track 2 is designed to encourage new technologies, usually developed by start-ups. These are usually under-funded and may not have the resources (financial, engineering or manpower) to obtain or even initiate planning and grid connection applications. Some have very interested partners who have put in so much resource to previous bids for support that they are unwilling to provide more without a degree of official indication of potential to win. Therefore, once chosen as eligible, funding and partnerial support for these activities will be much easier to obtain. Grant of eligibility does not commit Ofgem to the final contract, for which these will have to be in place. In line with Ofgem's express intent to encourage such new technologies, can the assessment accept a realistic approach to obtaining them within the 2033 timescale? (I note that in your consultation paper, the important assessments are economic, strategic and financial, not whether or not there are planning applications and grid connection offers in place.)

Encouraging new technologies

Track 2 is for new technologies. Can any promising technologies (as identified during the assessment), whether eligibility is granted or not, be referred to Ofgem's SIF for funding and other support with a positive assessment?

Application portal

It was not at all obvious how to find this within the portal site. Please put it as a headline within current bids.

The application asks for evidence per question; the guidance gives seven headings; these differ greatly, which entails an awful lot of work in compiling a single PDF per guidance heading, which may mean that some documents referred to in the application are overlooked. Why a single PDF? Why upload them by guidance heading, rather than using the file names referred to in the application - which is therefore sure to slow down assessors?

Application Process

There were a number of clarification questions along the lines of: if we get new and better information on our project, can we update our application? The answer was not until after the eligibility assessment. However this is a material issue: most partners / stakeholders (e.g. councils, NG, DNOs) work to their own timetables and not to yours, so there may be very material improvements between submission and eligibility assessment. In future rounds, can such updates be enabled if material? Maybe an update button with a selection of categories for the update, including "Other", so the assessors don't need to start again but can simply review the update to see whether the change affects the outcome?

Window 2

If granted eligibility for Window 1 and not granted a C&F contract, then can the same project be auto-eligible for Window 2 with the knowledge that it needs better information / further development to win the contract? And so on for future windows. This will give a degree of confidence to the partners to put in the cost and effort to get to that higher level, as well as reducing the cost (e.g. of re-applying for eligibility) and uncertainty before then. It may also enable them to spend the money to keep hold of the relevant land and grid connection.

Q1, 2.1 and 2.5 Capacities

Why limit the total capacity of LDES projects granted eligibility?

1. You can down-select them at grant stage - which gives you the opportunity to be more lenient at eligibility stage, to open the door wider to new participants and technologies.
    - It's for the company to decide whether (if at a slightly earlier stage of development) it is worth the cost and effort of getting to the next stage.
2. Why limit it at all, by capacity? The total need for LDES is so huge, and the lead times for most so long, that any limit will impact the grid adversely.
3. The problem is not too much LDES but too much short-duration storage cannibalising the best revenue streams needed by the LDES to make it profitable and so minimise calls on the floor guarantees. Less short-duration

storage => less subsidy needed for LDES => more LDES => cheaper and better system overall. Avoiding capacity caps on LDES at this stage (early on in development of this capability nation-wide) would achieve this while minimising regulatory intervention. See Revenue Stacking and Salami Slicing.

4. A need for up to 50.4GW of new LDES (then set at 5 hours average duration) was identified in 2012 (by the TINA) as being necessary for the grid. Since then, not a single MW has been built with that duration or longer. The problem is too little LDES, not too much.

Q1, 2.2 MCA Elements

It is good that you are trying to evaluate the un-monetised benefits and strategy.

Q2, 2.2, 2.6-2.13, NPV and revenue streams

Yes, use the NPV. The value to the system should bear in mind that:

1. As renewable penetration increases, so the value of each marginal MW of LDES increases.
2. Synchronous LDES adds vastly more value than asynchronous, and this too increases (even faster) with growing renewable penetration. See Inertia and Stability.
3. Real inertia is better than synthetic: synthetic is great for recovering from faults; only real prevents the faults cascading around the system in the first place (as well as recovering), as proved in the Iberian peninsula recently and in the UK 9/8/19. See Lessons for Europe from the UK Blackouts and Spanish and Portuguese black-outs.
4. For longer-lived technologies, also assess the NPV over its entire forecast plant life, e.g. CAES 50 years.
5. It is not right to expect each project to expound their own effects on consumers (c.f. Financial Assessment bullet): some will be better informed / more conservative than others, which will taint the views. By all means invite insights, but then apply those insights to all assessments.
6. Dispatch models are a very bad way of forecasting future demand of diverse technologies: they start to break down after 2-4 years; by 2030 they are awful, by 2033 useless. See Grid Modelling, p6 of An Affordable Reliable and Resilient Energy Transiton.
7. For revenue assessment, use the benefit to the system. For example, if the LDES is synchronous, then less ultra-fast response time battery support is needed as the synchronous plant delivers the voltage and frequency control/regulation naturally.
8. The cap should be raised if the plant provides more services, regardless of whether the plant's costs require the higher cap: this reflects the benefits to the system of the plant.

Q3, 2.14-2.16: Competition

As much more LDES is needed than will be built under Window 1, at this stage competition is not needed unless there are multiple projects competing for a location's grid capacity etc. and that grid capacity cannot reasonably be increased.

If plants bidding for 2030 tranche exceed the grid capacity of the area, but the grid is reinforceable by 2033, can those bids be granted eligibility for the second tranche?

Q4, 2.6-2.7, 2.17-2.19: Capturing difficult revenue streams

The challenge of capturing inertia-based revenues, such as ancillary services, are best addressed by evaluating the costs of building (including land), operating (including energy consumption), connecting to the grid, and paying for the reasonable profits of the developer and operator, a synchronous condenser of the same rating. If the plant has two trains (in the case of CAES, a compression train and an expansion train) which can be spun when not in use, then this is equivalent to two synchronous condensers of the same rating.

LDES and interconnectors are fundamentally different:

- Most LDES is naturally inertial; interconnectors are not.
- LDES has energy that can be relied upon; interconnectors do not: in a *kalte Dunkelflaute* after 2030 when all our neighbours will be importing during largely concurrent times of system stress, it is difficult (especially now we have Brexited) to conceive of a neighbouring country's politicians telling their electorate that a black-out was because they were exporting the necessary electricity. There would be riots.

However there are similarities in that neither generates new electricity: while the interconnector merely moves electricity in space, storage merely moves it in time. That is one of the many reasons why the regulatory definition of storage should be similar to that of an interconnector, not as a sub-set of generation. See Regulatory Definition of Storage. This mis-definition of storage is one of the principal reasons why a cap-and-floor regime is necessary. (There are other principal reasons too, which can be corrected at negative total system cost.)

2.20 Explicit Consideration of Financial Investment

As long as the revenue streams (including the synchronous condenser evaluation of synchronous benefits) and their growth (in line with increasing renewables penetration) are included, then this is good. However there is a problem in all NESO projections: for over a decade they have assumed that other technologies will come on stream in 3-5 years which will decrease balancing and ancillary service revenue streams, but these have never come in sufficient volume to have that effect, or even to reduce their rate of growth. This is a persistent forecasting fault relating to the use of dispatch models, despite having been pointed out year after year. Therefore such decreases - or even levelling-out - should be avoided.

Q5 and Q6, section 3, Right impacts / impacts not captured well

Omitted impacts include:

1. For avoided curtailment (3.4, 3.34), no mention is made of the System Operator costs of interventions to turn up alternative generation, e.g. a power station in the south providing the energy of a curtailed northern wind farm, to avoid constraints and to add ancillary services.
2. Most ancillary services can be evaluated by using the synchronous condenser analogy above
3. 3.24, 3.35-3.38, Account must be taken of the services deliverable ***concurrently and with the same capacity*** by synchronous plant, e.g. when discharging energy they deliver concurrent reactive power, inertia, voltage and frequency control, phase-locked loops, leakage current protection etc. at no

additional operational cost; when charging they deliver concurrent reactive load and all the others too; by adjusting operating parameters, the reactive power/load can be adjusted with minimal impact on energy consumption or efficiency.
    - Asynchronous plants deliver synthetic inertia which is of lower value (see above), which cannot deliver some services, and which consumes further capital costs (3.25) and energy (which should be included in the debit side of the calculation).
    - The method identified above of assessing the costs of an equivalent-rated synchronous condenser will enable this to be evaluated.
    - 3.38 You need to assess what is delivered concurrently with what - and in which direction. For example, if a 2-train CAES plant is delivering energy, then it delivers everything else with the same train. If spinning the other train, then it is delivering the same "everything else" but not the energy with that train.
4. Avoided grid reinforcement, especially if operated counter-cyclically when (like the justification of the Leighton Buzzard battery) they create grid capacity rather than consuming it.
    - This is also a reason why the assessment and allocation of grid capacity for LDES is wrong. Maybe to correct it there need to be some System Operator run constraints on its operating mode, but suitable storage operated suitably creates rather than consumes grid capacity.
    - A decade ago, when DNOs and the DSO were allowed to build batteries, when they proposed them they were evaluated as creating grid capacity, whereas when anyone else proposed them they were evaluated as consuming it.
    - 3.39 is an inadequate treatment of it.
5. Constraint cost reductions.
6. Reductions in wholesale prices as well as balancing and ancillary market prices, versus a counter-factual without the storage, regionally and shared between the projects approved within the region: by padding LDES capacity, these market prices will drop, which is a benefit to the consumer additional to 3.18-3.19. Similarly for reductions in CfD prices, 3.20.

Other considerations:

1. Wholesale market costs: a substantial proportion of LDES income will be from balancing and ancillary services, rather than from wholesale arbitrage.
2. There is no provision whatsoever for remunerating LDES between large-scale renewables and the grid, which reduces grid reinforcement (by clipping or eliminating peaks) and (if synchronous) adds all the ancillary services and synchronicity before the asynchronous energy hits the grid. Indeed, with a suitably scaled (size and duration) LDES between the renewables and the grid, then the {renewables+storage} can be dispatched like a power station, not only saving reinforcement, balancing and ancillary costs but also control room and other costs and complexities. Nonetheless, such an arrangement is penalised by current regulations and market designs which only pay CfDs etc. for renewable energy that hits the grid, which is reduced by the inefficiency of the storage despite the value of that energy being so much greater. But this is for another Window.

3. 3.11-3.17 Such intra-day flexibility is able to be evaluated by identifying historical 95th percentile worst-case intra-day flexibility needs as a percentage of total demand, establishing a cost paid to achieve that, increasing that cost over time to reflect the increasing renewables penetration, and sharing it among storage plants. This would best be done regionally, though nationally is better than nothing.
4. 3.40-3.42 ETS carbon prices are inadequate as analysts are unanimous in that they are far lower than the societal cost of emissions. The latter should be chosen, as analysed by a due authority such as the UNFCCC or previous British parliamentary reports. This will help to monetise 3.43-3.48 also.
5. 3.50-3.51 The types of jobs created are important. For example, batteries draw on the scarce resource of battery trained people, whereas CAES draws on the plentiful resource of power station trained people and re-purposes their training for the green economy.

Q7, system-level benefits not captured

There is no evaluation or consideration of:

1. 3.31-3.33 Security of Supply, Reduction in reliance upon imports during future Europe-wide times of system stress, such as the *kalte Dunkelflaute*, see my response to Q4 above.
2. 3.9, Capacity market impacts: new LDES with 15-25 year contracts is of much greater benefit than shorter-duration storage or generation with 1-year contracts, in the T-4 Capacity Market; therefore any such impacts on T-4 should be accounted in favour of the LDES.

Yours,

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