Regulatory Definition of Storage

What Is Storage?

Storage stores electricity. It does not generate new electricity (except for traditional CAES, see next paragraph): it only re-sells the electricity (minus losses) that it purchased. It is therefore not generation. It moves electricity in time, much as interconnectors move it in location.

Traditional CAES alone is a mix of generation and storage, because it burns fuel to re-heat the air. It can be treated partly as storage and partly as generation, in proportion to the percentage of the output energy that derives from the fuel. Adiabatic CAES does not have this issue: it is pure storage.

Triple Charging

There is a general mis-perception that storage is double-charged for grid access charges: paying for consumption and again for generation. It does, but also the electricity purchased has also already paid charges, so storage is actually triple-charged.

Interconnectors do not pay for grid access, though the electricity they carry has already had grid access charges paid. This is correct: they are merely an extension of the grid, providing grid services. The same is true of storage: it merely provides grid services and therefore should not be charged for grid access.

How the Decision Was Made (One Aspect)

Naturally the incumbent generators want to keep it this way, to keep the playing-field tilted sharply in their favour. Storage companies want “zero charging” (i.e. reduce to charging only for the purchased electricity) on the grounds that storage doesn’t generate. So Ofgem decided to split the difference and define storage as generation.

They stated that this was a partial solution, adopted because it didn’t need primary legislation; when the opportunity for primary legislation would occur, then they would seek to create a true definition of storage[1]. However now they are proposing to

[1] From the Smart, Flexible Electricity System consultation paper published jointly by BEIS and Ofgem, November 2016:

- "In line with the plans both Government and Ofgem set out last year, we have considered a range of options to deliver a smart energy system, including: removing barriers to storage and DSR; ..." Towards a smart, flexible energy system para.20.
- "We have found that storage faces a number of barriers", as an introduction to a request for ideas to remove those barriers. Towards a smart, flexible energy system para.22.
- "Government has identified a number of potential priority areas over the next 5 years: ... storage costs. ..." Towards a smart, flexible energy system para.50.
- Towards a smart, flexible energy system, Table 1:
    - "In the final plan we will set out implementation tasks and timelines for: Any further measures to make it easier for storage to connect to the network - A decision on regulatory definition for storage and whether a new licence is required".
    - "Our aim: a level playing field for DSR and storage competing with other forms of flexibility and more traditional solutions."

define storage in primary legislation, which defeats the purpose of the interim solution and prevents a correct definition.

They now say that they wish to define it as storage because they can base the definition on existing regulatory categories. But that would be the case equally if they based the definition of storage on that of interconnectors – and with fewer modifications needed.

I am told that the industry is happy with the current proposal. Given that the industry is dominated by incumbent generators, that does not surprise me. However the need for change was also identified by the National Infrastructure Commission[2].

Problems with Defining Storage as Generation
There are many problems with defining storage as generation, which can be summarised as:

1. Charging
2. Grid Code Requirements
3. Grid Operator Constraints
4. Grid Connection Costs
5. Contractual
6. Trading as Renewable Electricity
7. Grid Charges
8. HM Treasury
9. Sundry Regulations

1. Charging
As cited at the beginning of this document, storage is triple-charged for grid access; the proposal is to move it to double-charged. This keeps the playing-field tilted in favour of generation and interconnectors, which are both single-charged – generation as generation and interconnectors within the price of electricity purchased. This therefore subsidises generation at the cost of the bill-payer. It provides even more subsidies to foreign generation and of the UK bill-payer, as grid connection charges for generation are lower on the continent than in the UK and the

[2] In the National Infrastructure Commission's report on Smart Power recommendation 2a) was that "DECC and Ofgem should review the regulatory and legal status of storage to remove outdated barriers and to enable storage to compete fairly with generation across the various interlinked electricity markets. The reforms should be proposed by Spring 2017 and implemented as soon as possible thereafter."
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/505218/IC_Energy_Report_web.pdf - note 17 to Introduction, Table 2.

2. Removing policy and regulatory barriers, 2.1 Enabling storage

- "1. There is increasing interest in energy storage as a potential source of flexibility for our energy system"
- "2. Falling costs are one element of bringing forward large scale storage projects – the market and its structures must also recognise and reward storage for the value it brings to the energy system."
- "3. We are seeking views on solutions; both for individual barriers and whether some solutions could address multiple barriers e.g. regulatory clarity."

UK does not charge differential fees (i.e. the difference). It is the bill-payer who loses out most because it disadvantages the most cost-effective means of balancing the grid.

2. Grid Code Requirements

The grid code for generation is loaded with requirements that are suitable for generation (e.g. 15% over-generation capability) but unsuitable for storage. This is right and proper owing to the nature of the generation asset being regulated – but therefore not right or proper for storage. The code for interconnectors does not have most of these, and therefore is much more suitable for storage.

Ofgem says that the grid code is determined by the industry, and therefore the grid code consequences of the regulatory mis-definition of storage are not their responsibility. But this overlooks that (a) the grid code is built on the regulatory definitions and reflects them, and (b) those with the greatest input into grid code matters are the large incumbent generators who have sufficient resources and who also have little interest in storage in comparison with their interest in generation.

3. Grid Operator Constraints

Both transmission and distribution operators are banned from owning generation, with a derogation of up to 6MW for DNOs. Yet both see huge potential benefits from storage, in balancing the grid, in providing stabilisation services, and in alleviating constraints and deferring capital investment. Both would invest in storage if permitted. And both would wish to support storage with NIC / NIA funding, which they are not permitted to do while storage is defined as generation.

Defining storage as storage would enable this. But it would also give the flexibility of allowing, disallowing and/or constraining such ownership and/or operation, as regulations (rather than primary legislation) can be used to do so – if storage is defined as storage rather than as generation.

And the ability to invest NIA / NIC funds in storage and in the issues relating to it (e.g. developing a standard system for calculating its effects on grid capacity, such as alleviating congestion like the Leighton Buzzard and Orkney plants) would greatly assist the network to adjust to a zero-carbon future.

4. Grid Connection Costs

Currently the effects of a proposed plant on grid loads is to calculate its operation as consumption, and again to calculate it as generation. This maximises the cost and lead time of grid connections, thereby making storage much more expensive and severely constraining the locations in which it can cost-effectively be built.

Storage mostly acts counter-cyclically, alleviating rather than creating grid congestion. It is on this basis that the batteries in Leighton Buzzard, Orkney and Eigha were proposed. Therefore grid connection requirements should be calculated based on storage being storage, not on it being generation and/or consumption.

Doing so would reduce connection costs and lead times, consequently increasing its roll-out and reducing consumer costs.

Likewise, operational grid access charges would need their own computation to encourage storage to alleviate grid challenges, and thereby speed roll-out and reduce consumers' bills.

Creating such models would be ideal subjects for NIA / NIC projects. There may be a conclusion whereby different constraints in operating modes of storage would incur different connection construction costs and ongoing charges.

5. Contractual

National Grid is unable to enter into a contract for "storage services" which cuts across many current and proposed contract types, because storage is not legally defined as such. This means that storage has to bid for a huge revenue stack of separate services, every 2 years or less, with many adverse consequences, including:

- The TSO / DSO has huge administrative and grid control burdens as they can't just ask the storage to respond to a situation – they have to select from a vast menu of situations and responses before triggering each one individually.
- We are eligible for a stack of 12 contracts, with another 4-6 being mooted at present. This means that we have to administer 12-18 contracts concurrently, ensuring correct compliance, invoicing and contract management for each, adding enormously to our administrative costs which we would have to reflect in our prices, which ultimately will cost the consumer a lot.
- Each of these revenue streams needs to be re-bid every 6-24 months, with consequent administrative burden on both us and the TSO / DSO, again adding to consumer costs.
- Each of these bids has a chance of failing to win a contract, meaning that –
    - We have to price in the possibility of failure, having to operate for a period without a contract or having to fill that "slot" with a lesser-paying contract;
    - We also have to price in the additional administrative costs of having to bid for more contracts than we win;
    - Our financing costs will be higher owing to the commercial risk;
    - And all these costs will ultimately be passed on to the consumer.

With a regulatory definition of storage as storage, the TSO / DSO would be able to let contracts for "storage services", maybe split into primary and secondary to reflect different storage types and characteristics – PHES and CAES as primary and batteries / DSR as secondary, with flow batteries maybe being able to choose.

6. Trading as Renewable Electricity; Grid Charges

Even when storage adds no carbon, because it's defined as generation but is not renewable generation, the output from storage is not classed as zero-carbon renewable energy. Therefore it cannot trade its output as renewable energy. This

prevents it selling renewable Power Purchase Agreements, or entering into many other such contract.

7. Grid Charges
Because storage wrongly cannot trade renewable energy, it wrongly incurs grid charges (e.g. to pay for renewable incentives) that do not apply to renewables.

8. HM Treasury
The Treasury offers certain incentives for investment, such as the Enterprise Investment Scheme (EIS), which explicitly list generation as ineligible. The Treasury uses the regulatory definition of storage (currently generation plus consumption) as its own definition. Therefore defining storage as generation will greatly reduce investment into storage, and increase the returns that investors require for doing so, and thereby increase the cost of de-carbonising the grid.

9. Sundry Regulations
Other regulations, such as planning regulations, also base some of their rules on whether or not a plant is or will be generation. Mis-defining storage as generation would continue to ensure that storage is judged by characteristics that it does not possess, often to its (and thus the grid's and consequently the consumer's) disadvantage.

Proposal
Define storage, in primary legislation, as storage.

Base the definition on that of interconnectors.

The grid code would therefore be modified, based on interconnectors rather than trying to fit a round storage peg into a square generation hole.

This would mean that additional issues don't keep raising their heads (such as the OFTO issue, discovered in 2019, and the "selling as renewables" and "grid charges"issues, discovered in 2020) – they would be dealt with once and for all by a proper definition of storage as storage.

- Failing to do so would require continuous and ongoing adjustments to regulations and grid codes to accommodate each new issue, making both regulations and grid codes excessively complicated and patched-up with consequent potential for confusion and mutually conflicting provisions.

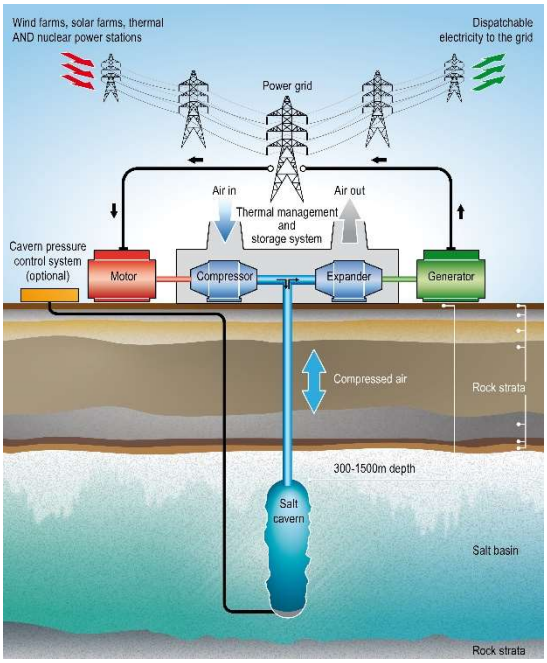
Enable contracts for "storage services" to be let by the TSO and DSOs.

Grid-scale electricity storage
using an innovative form of
Compressed Air Energy Storage

About Storelectric

Storelectric (www.storelectric.com) is developing transmission and distribution grid-scale energy storage.

- Innovative adiabatic Compressed Air Energy Storage (TES CAES). Our 500MW, 2.5-21GWh installations have zero/low emissions, operate at 68-70% round trip efficiency, levelised cost significantly below that of gas-fired peaking plants, and use existing, off-the-shelf equipment.
- Their CCGT CAES technology converts and gives new economic life to gas-fired power stations, halving emissions and adding storage revenues. Addresses the entire energy trilemma: the world's most cost-effective and widely implementable large scale energy storage technology, turning locally generated renewable energy into dispatchable electricity.



The potential to store the entire continent's energy requirements for over a week; potential globally is greater still. In the future, Storelectric will further develop both these and hybrid technologies, and other geologies for CAES.

About the Author

Mark Howitt is Chief Technical Officer, a founding director of Storelectric. He leads Storelectric's technical and operations, minimising technological risk, maximising efficiency and environmental friendliness, and speed to market. He focuses on technologically simple solutions using proven technologies wherever possible.

His degree was in Physics with Electronics. He has 12 years' management and innovation consultancy experience world-wide. In a rail multinational, Mark developed 3 profitable and successful businesses: in commercialising a non-destructive technology he had innovated, in logistics and in equipment overhaul. In electronics manufacturing, he developed and introduced to the markets 5 product ranges and helped 2 businesses grow strategically.