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

Developing projects on weak and saturated grids

Many large renewable generation projects and interconnectors are stalled because the grid to which they would connect is weak and/or saturated, requiring hugely costly grid reinforcement before the renewables can be connected, which makes the project impractical.

Connecting More Renewables

However, if large-scale long-duration storage (such as Storelectric's) is connected to the grid connection of an existing wind farm, another wind farm the same size can be connected without any grid reinforcement. For solar, two more can be added. Alternatively, a brand new wind farm can be connected with a half-sized grid connection (solar, one-third). All of these options benefit the developer in many ways, such as:

- Halving (or reducing by two-thirds) the size of grid connection –
  - Reduces capital costs for the renewables farm,
  - Proportionate reduction in annual grid connection charges,
  - Greatly reduces the grid reinforcement needed;
- Storage sharing the grid connection with the renewables farm –
  - Eliminating its grid connection costs and annual charges;
- The renewables farm "sells" its energy to the storage, down a "private wire" –
  - Eliminates grid access charges for energy sold by the wind farm,
  - Eliminates grid access charges for energy bought by the storage,
  - Gives a long-term PPA for both;
- The storage adds value-added services for the grid, including –
  - Output energy is dispatchable rather than intermittent,
  - Balancing services such as FRR and FCR
  - Inertia, reactive power/load, black start etc. (see below).

Put another way, if there is an existing 100MW solar farm, adding 100MW storage would enable the addition of a further 200MW solar farm (100MW if wind farms) to the same grid connection – in addition to improving grid stability. This enables substantial increases in renewable generation even in locations with saturated or weak grids.

Inertia, Grid Stability etc.

Weak and saturated grids also suffer from low stability. This is often because wind, solar and interconnectors are all DC coupled to the electricity grid, and so have no

natural inertia. For this reason, additional renewable generating capacity would merely make the problems worse. Storelectric's CAES is naturally inertial and can therefore greatly improve grid stability, able to be designed with:

- Real inertia 24/7 at twice the rate of an equivalent-sized power station;
- Real reactive power and load 24/7 at ~6x the rate of a power station;
- Fault (e.g. short-circuit) current protection;
- Black start, if designed in at the outset.

Synergies with Interconnectors

When there is no demand across the interconnector, energy can still be transported for future needs if transported into storage. In the same way, it can still be bought and stored for future transportation against future needs.

If solar generation alone is connected to an interconnector, the volume of electricity carried daily can increase roughly 6-fold with storage between the solar farm and the interconnector. At the other end of the interconnector, storage can convert inertia-free baseload input into dispatchable output with natural inertia and reactive power / load.

About Storelectric

Storelectric (www.storelectric.com) is developing the world's two most cost-effective large-scale long-duration electricity storage technologies. **TES CAES** is uniquely efficient (68-70%) and emissions-free, and a simplification of existing (and much less efficient) CAES designs. **CCGT CAES** is uniquely retro-fittable to suitably located power stations, halving emissions while cutting costs and adding storage-related revenue streams, thereby re-lifing stranded assets. **Both** are built with today's standard equipment. They are the key to matching intermittent renewable energy with variable and even baseload demand, thereby enabling renewables to power the world's grids and future energy needs. There are potential sites for enough plants to balance and support grids around the world.

Storelectric's CAES plants are usually designed as stand-alone plants with stand-alone profits based on buying electricity from the grid and selling it back to the grid. Added to this are many potential up-side revenue streams, such as buying and selling under PPAs (Private Purchase Agreements), trading currently untraded services, providing Black Start and related services, and trading services on the distribution grid. Added to these are the potentially enormous synergies related to co-location (either real or virtual) with renewable generation and interconnectors.

Typical plant sizes are 40MW to multi-GW, with durations from 4 hours to multi-days. The next stage is to build a small but economically remunerative plant of each type, for which Storelectric is currently raising funds. Construction will take ~3 years from funding, and the first larger-scale plant a further 3-4 years. Storelectric is supported by global multinationals who cover all the technologies involved, their installation, financial and legal aspects. In the future, Storelectric will further develop both these and hybrids of them, and other geologies for CAES. Both technologies are suited to the hydrogen economy.