# Costing the Energy Transition

Nobody has done a full costing of the electricity system of today and of 2050 to identify the cheapest way of de-carbonising / cheapest way of providing the electricity system that each country needs. Instead, vision is short and narrow to the point of being blinkered: will this technology pay back in 5–10 years in today's markets, ignoring all other matters?

Policy decisions can only be taken sensibly if alternative scenarios are fully costed. Therefore grids, governments and analysts should undertake such analyses, on which I would happily consult.

First, the cost of today's system needs to be assessed. This includes:

- Contracts, including with the ever-increasing plethora of advisors and middle-men (who are ultimately rolled up into contract costs).
- Subsidies (e.g. CfDs, OFTOs in the UK) and their administration.
- Hidden subsidies (e.g. under-payment of carbon emissions which are valued generally at ~$120/tonne but charged ~$35 in the UK, £25 in the EU and zero in most other places) - charging for emissions charges for the harm done to the world by those emissions and therefore levels the playing-field with technologies that don't cause such harm.
- Distributed systems and self-consumption, as these installations take a capital and maintenance cost that differs according to scenario (this will be estimated).

Then various 2050 scenarios should be modelled, to set the direction of travel / objectives, and the permissible variants. It would also enable the conditions to be set at which other technologies can be adopted or rejected, e.g. tidal range provided its levelised cost is below $x/MWh, a new storage technology if below $y/MWh. Grid stability under each scenario should also be modelled. Expected outcomes include:

1. With lots of large-scale long-duration storage in the system, total system costs will be lower than today's; without it, they'll be much higher.
2. Very distributed scenarios require as much grid-based back-up as less-distributed scenarios, and will therefore be more expensive overall.
3. To pay for grid-supplied back-up, bills need to be re-balanced towards standing charges (proportional to connection sizes) and away from per-unit charges; how to help the poor is a political decision outside this, noting that the poor can't afford solar panels and batteries.
4. Maximising grid stability requires a minimum amount of real inertia (probably the greater of a percentage of all generation, and the size of the largest two single potential points of failure) to enable the system to ride through faults without black-outs like the UK's on 9th August 2019.

Finally, various ways of getting from here to there need to be modelled, as different pathways cost different amounts of both money, disruption and grid stability. then drawing conclusions and policy recommendations from the models. Expected outcomes include:

1. Letting contracts according to my proposed regulatory system will greatly reduce costs and increase system stability; evolutions of the current system will do the reverse.
2. 2050 technologies need to be incentivised and built quickly, starting now while they're not so essential, because of lead times not only to build them but also to adapt the grid to accommodate them.
3. Incentives should be designed to prevent blind alleys being followed, e.g. a dash for gas that would achieve 2030 emissions targets but yield stranded assets by 2040 or 2050; or an over-reliance on imported electricity in the short term if in the medium or long term there will be insufficient surplus electricity in the exporting country during times of system stress.

If all this is done and policies are set accordingly, I believe that the de-carbonised electricity system of the future will be cheaper than today's, just as diverse in the generation and storage technologies used, and highly stable.

## About Storelectric

Storelectric (www.storelectric.com) is developing truly grid-scale energy storage using an innovative form of Compressed Air Energy Storage (CAES). This uses existing, off-the-shelf equipment to create installations of 500MW, 2-21GWh with zero or low emissions, operating at 68-70% round trip efficiency, at a cost of £350m (€500m) (estimated for 3rd – 5th plant), and a levelised cost cheaper than that of gas-fired peaking plants (OCGT). Capex is one-third that of pumped hydro per MW and 1/75th per MWh; similar to 10-year target prices of batteries per MW and less than 1/1,000th per MWh. There is potential in the UK to store the entire continent's energy requirements for over a week; potential in mainland Europe and the USA is greater still, with global roll-out planned.

The next stage is to build a 40MW, 200MWh pilot plant with over 62% efficiency (grid-to-grid), using scale versions of the same technology, for which Storelectric is currently raising funds. Construction will take 2-3 years from funding, and the first full-scale plant a further 3-4 years. The consortium includes global multinationals who cover all the technologies involved, their installation, financial and legal aspects.

Storelectric has a second technology, CCGT CAES, which is the only CAES technology that is retro-fittable to a suitably located gas-fired power station (either CCGT or OCGT). As such it is a very good value technology that can almost halve emissions and add storage-related revenue streams, giving new life to stranded assets. It is an excellent transitional technology.

In the future, Storelectric will further develop both these and hybrid technologies, and other geologies for CAES.

## About the Author

Mark Howitt is a founding director of Storelectric. He leads Storelectric's technical and operations, minimising technological risk, maximising efficiency and environmental friendliness, and speed to market. 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 his technology, 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.