Revenue Stacking and Salami Slicing

A Salami Slicing Approach

Large-scale long-duration and flexible plants of most types (both generation and storage) rely on stacks of diverse revenue streams to be profitable. This sticking plaster approach to the challengers of the energy transition means that each issue is turned into a contract / revenue stream, one at a time, as it is discovered and quantified. The largest and most remunerative ones (e.g. EFR) are contracted first, because those are the most urgent and greatest need.

Because these needs are addressed individually and with short term contracts, they are delivered by short-lived and small-scale solutions (e.g. batteries, synchronous condensers). Long-lived & large-scale solutions that address many such challenges, and especially those which tackle the root cause of the problems, cannot be financed under short term salami-sliced contracts: they need an entire revenue stack.

This salami slicing, sticking-plaster approach means that narrowly focused, less capable and harder-to-managed plants are built to cream off the most remunerative parts of the revenue stack. This renders the remainder of that stack less profitable, as the plants that are capable of delivering the remainder need to amortise their costs over the remaining contracts, thereby inflating the costs of those contracts. This means that the total cost to the market of all contracts increases: the easy-to-let contracts include the amortisation of the plants that can deliver them, and the harder-to-let contracts include the amortisation of the plants that can deliver not just those but the easier contracts too. The result is that the market has to bear the costs of unnecessary investment in inflexible and less-capable plants.

Moreover, as they bid for one slice at a time, they cannot rely on winning other slices – or, when these contracts (which usually have short durations, less than 2 years) come up for renewal / re-bid, to win them again, so they must over-price their amortisation in each contract. And this inflates the total market costs still further.

Impossible Choices that Result

Take, as an example, a highly flexible inertial storage plant (there are a number of such technologies on offer). If they win a contract for balancing services, but lose the contract for inertia, then they cannot deliver the balancing without spinning their equipment and delivering inertia. So,

- If the Transmission Operator (TO) takes the inertia without remuneration, then (a) they would be stealing an otherwise-remunerated service, and be sued by the storage provider and (b) they would be sued for breach of contract by the winner of the inertia contract for non-fulfilment.
- If the TO were to remunerate the storage, then (a) would be satisfied but (b) would not.
- If the TO were to penalise the storage for delivering uncontracted inertia, then (a) would be rendered unable to deliver its contracted balancing services, while (b) may be satisfied by compensation.

Sub-Optimal Choices that Result

Considering the same case of inertial storage plant, if it can deliver various grades and durations of response (e.g. Frequency Response, Fast Reserve and BM Start-up) by running the plant for the first and keeping it running for the others, then it can do so much more cheaply than if (for example) it were to win the Frequency Response and BM Start-up contracts but lose the Fast Reserve contract and have to switch off in between. So awarding the contracts together can benefit both consumer (cheaper contracts) and provider, while making the grid more cheaply and easily manageable.

If a plant can deliver a dozen services, it cannot bank on winning all twelve contracts every time they are built. Therefore it needs to recover its costs on an expectation of the number of contracts it will win (say, eight). This will increase its cost recovery rate by 50%, putting up the prices to consumers; and if the plant wins all 12, it would over-recover by 50% and so earn excess profits which the regulator cannot prevent as it's the cost of the commercial risk created by the salami sliced system.

If, in raising the risk premium on the plant's cost recovery, the total contract price then rises above a less-economical plant's, then the grid will contract with the less-economic plant rather than the more-economic one. Usually the less-economic plant will have narrower capabilities than the more-economic one. This will have a cascade effect through the entire range of services provided by the more-economic plant, putting up the prices it must bid (so as not to operate at a loss) for each contract and so making them uneconomic every individual contract when in reality they would have been substantially cheaper for all the services if contracted together – so the consumer loses.

Minimising Overall System Cost

To minimise the overall system cost and maximise its security of supply, and to do these over the short, medium and long terms, a better approach is to address the causes of the problems, principally the need for clean (i.e. low or preferably zero emissions) inertial generation and load. Contracts for these should be let for a suitable time. They should then be contracted to deliver whatever other services they can deliver cost-effectively to the system, thereby giving them their entire revenue stack without any increase in price, without any overt or covert subsidy. It is only after this is complete that shortfalls should be evaluated and let in narrow, shorter duration contracts. Further details on contractual/regulatory proposals are here.

The current situation is like someone wanting to buy a car for general use for the household, but being compelled to contract for one product for acceleration (a.k.a. ancillary services), another for distance (a.k.a. duration), a different one for handling (a.k.a. stability services), a fourth one for starting the engine (a.k.a. Black Start) and multiple small ones to aggregate to suitable family-carrying capacity... It just doesn't procure what's needed, which is a single car with the best blend of size, handling and performance.

Failing to minimise overall system cost in this way will not remove the business case for large scale long duration renewables, because the need will remain. The main effect of such failure is to increase its cost to the system.

About Storelectric

Storelectric (www.storelectric.com) is developing transmission and distribution grid-scale energy storage to enable renewables to power grids reliably and cost-effectively: the world's most cost-effective and widely implementable large-scale energy storage technology, turning locally generated renewable energy into dispatchable electricity.

- Innovative adiabatic Compressed Air Energy Storage (Green CAES ™) will 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.
- Hydrogen CAES ™ technology converts & gives new economic life to gas-fired power stations, reducing emissions and adding storage revenues; hydrogen compatible.

Both technologies will operate at scales of 20MW to multi-GW and durations from 4 hours to multi-day. With the potential to store the entire continent's energy requirements for over a week, global potential is greater still. In the future, Storelectric will further develop both these and hybrid technologies, and other geologies for CAES, all of which will greatly improve storage cost, duration, efficiency and global potential.

About the Author

Mark Howitt is Chief Technical Officer, a founding director of Storelectric. He is also a United Nations expert advisor in energy transition technologies, economics, regulation and politics – invitation here – and advisor to other bodies too.

A graduate in Physics with Electronics, he has 12 years' world-wide management and innovation consultancy experience. In a rail multinational, Mark transformed processes and developed 3 profitable and successful businesses: in commercialising a non-destructive technology he had innovated, in logistics (innovating services) and in equipment overhaul. In electronics manufacturing, he developed and introduced to the markets 5 product ranges and helped 2 businesses expand into new markets.