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Strategic energy market intelligence

What next for embedded benefits?

By Nigel Cornwall

Earlier this week the Association for Distributed Energy (ADE) published a research report we have written on "embedded benefits" (or the payments distribution-connected generators can earn from reducing network usage).

The immediate backdrop to the report is recent policy steers from DECC. In particular on 1 March it issued a consultation on reforms to the capacity market in which it confirmed that Ofgem had been asked to review current network charging rules and how they impact on embedded generation. It suggested they could be providing undue reward to distribution-connected generators, highlighting diesel reciprocating engines as particular and unworthy beneficiaries. Independently National Grid is also carrying out its own review focusing on the so-called triad benefit.

As we explain here, these reviews are of fundamental interest to the many generators connected at distribution voltages and could have profound implications for the viability of smaller generation schemes, both operating and planned. More generally, they raise fundamental issues about the interactions between industry charging rules and investment, directly feeding into the three key pillars of energy policy - security of supply, decarbonisation and affordability.

But in bringing forward our report, we do not recommend specific changes or reforms; indeed the issues are much too complex to take any particular element in isolation at this early stage. We argue there is an overwhelming case for a joined up review of embedded benefits across industry rules.

An embedded generator connects directly to the distribution network and locates close to the demand that it services. There are a number of operational benefits but also cost efficiencies in the form of avoided charges, and these are conventionally shared between suppliers and the local producers who they contract with.

Most obviously predictable local generation reduces the need for investment at the distribution and transmission network levels. But there is also a saving from the costs of network companies in operating and maintaining the existing infrastructure. There is a further reduction in thermal losses—the lost power dissipated through heat—both at transmission and distribution levels. Finally, embedded generation generally reduces the volume from balancing energy and can make it cheaper to balance the system on a half hour by half hour basis. Controllable plant such as reciprocating engines can also make it easier to deal with intermittency at the local level, allowing increased deployment of intermittent plant than would otherwise be feasible.

There is now around 20GW of generation that is connected to the distribution network, and it is having a big impact on the development of the electricity system. A large swathe of this, about 40%, is not intermittent, and a further 2GW has earned contracts under the first two capacity market auctions providing valuable reserve and flexibility in a world of shrinking capacity margins.

Perversely DECC seems to see this not as a good news story, but as a problem and an important factor to explain why large baseload CCGT stations typically connected at transmission level have not come forward. The implication is that embedded benefits are providing an unfair commercial advantage to smaller plant, and it therefore wants to levelise the playing field by reducing or even eliminating them. This is very muddled thinking.

The value of these benefits to each generator varies considerably dependent upon location and technology. In general the closer the generator is to demand and the more predictable and controllable the production, the higher they are. But a key issue that DECC has not recognized is that generators do not receive these payments directly; rather they have to negotiate a share out of these benefits under their Power Purchase Agreements with suppliers. Most agreements focus on the triad benefit, not least as historically this has been the most important source of embedded value, but it is not unusual for many older or longer term agreements not to mention some benefits at all. It is also conventional for suppliers to retain a share of the values, which can be up to 20%, as well as discounting the value of the power they purchase relative to the wholesale market.

We estimate that the total level of embedded benefits—the avoided costs shared by suppliers with local producers—has almost doubled from around £300mn to £560mn over the last five years if one looks across the seven sources of value. This is due not only to a combination of increased volumes of generators connected at low voltage following the roll-out of low-carbon incentives, but also an increase in the rate of some of these benefits as demand falls on the system.

Our research for the ADE suggests several key conclusions:

- when the current level of embedded benefits is assessed as a whole, we believe they are broadly providing a fair level of reward to generators for the various costs that they help avoid across the system as a whole and the operational benefits they can deliver over the long run;
- there are a number of issues with individual embedded benefits which mean that some are likely to over or understate the value to network companies and suppliers, and this varies by generation type and location; and

- while the "triad benefit" that arises from reduced use of the transmission system is overvalued, particularly when assessed over the short term, the credit available for reducing a distributor's costs through offsetting local demand is significantly undervalued over any timeframe.

In terms of the triad benefit, the conclusion explains why DECC, Ofgem and National Grid are all keen to push through review. But even here our analysis suggests that many of the sunk costs actually vary with demand when a long-term view is adopted, and the extent of the implied reduction is rather less than industry analysis has suggested.

As for distribution, we believe that current charging methodologies understate the benefits of the avoided costs from embedded generators. Firstly, non-intermittent generation currently receive credits for exporting on to a distributor's network, but the level of credits is lower than the equivalent charge to demand customers. This means perversely that generators can get more benefit from installing private wires to demand customers and bypassing the distribution network. Secondly, at higher voltages intermittent generation does not get a credit even though it can still contribute to reduced reinforcement cost for the distributor as part of a diverse portfolio of generation.

So our headline conclusion is that much more work is needed to understand these incentives, how they are realised contractually and their interaction, and any change should only follow a thorough, wide-ranging review. A piecemeal approach to change of individual benefits would almost certainly impact adversely on the viability of existing embedded generators but also reduce future investment at a time when margins are at historically very low levels and security of supply has become politicised.

Another key conclusion we have reached based on our research but outwith the scope of the report is that immediate changes to embedded benefits through reforming transmission charging would have a number of adverse effects.

It is true that transmission costs to demand customers would reduce if triad benefits were reduced or eliminated. However, there would be immediate offsetting costs, including:

- a higher capacity market clearing price paid to all generators who are successful in the auction through the elimination of typically price taking smaller generation (though admittedly this may be what DECC wishes to achieve);
- higher wholesale prices, reflecting an increase in the marginal cost of generation as new lower cost stations do not materialize and given the potential closure of embedded generation in response to the removal of triad benefits;
- an increase in the cost of ancillary services as embedded generators staying on the system need to make up for a shortfall in their revenue through higher contract prices;
- higher levels of reinforcement and other costs on the transmission system as embedded generation is replaced by transmission-connected generation (perversely increasing the implied value of generation connecting at low voltage);
- higher levels of reinforcement and other costs at the distribution network level as the export from embedded generation is reduced increasing local power flows;
- higher volumes of losses as power is shipped in from further away;
- potentially higher balancing costs, as national imbalance volume increases; and
- crucially in terms of the bigger picture, a higher cost of capital for all generation due to the increased risk associated with industry change.

In the round we believe these impacts would create a significant net detriment to consumers through higher prices but lower security especially in the near term.

As important, there could be immediate and detrimental impacts on investment. Over 2GW of investment that has occurred in the last two capacity market auction rounds, worth an estimated £500mn, could disappear, and competition in future auctions would be immediately diminished.

But what seems to have been missed is that the main impact from change would be on existing embedded plant. Much of this is not intermittent but is reliable and controllable. It is making a real and important contribution to security of supply, particularly at the local level and as back-up to industry. Embedded benefits contribute between 20%-50% to a generator's revenues, and the importance of this value stream has increased with falling energy prices and the abrupt loss of LECs, which has already been very detrimental to investor sentiment. We believe several gigawatts of plant could be put at risk by isolated action against the triad benefit, with a direct impact on the capacity requirement sitting behind the capacity market.

For every gigawatt of existing plant that goes off the system, we estimate capacity market costs would increase by between £30-£60mn. Given lead times for new build, it is also likely that further interventions would be needed by the system operator to reintroduce contingency balancing services to counteract crashing security margins.

There are likely to be other unintended consequences of piecemeal change and short-sighted interventions. There are operational inefficiencies at the local level, especially arising from high levels of unmonitored export ("spill"), which controllable and flexible generation can help meet and which should enable more efficient asset utilisation in an increasingly intermittent generation system. In a world in which we are supposed to be moving to characterised by decentralised local markets and active network management, the value of responsive embedded generation to the wider system should increase. It is an essential accompaniment to large-scale CCGT roll-out at the transmission level and an evolution to a smarter system, not a threat to realization of either.

In addition there is a real risk of killing off flexibility markets before they have developed. The GB electricity market is becoming more diverse and uncertain. Flexibility is key to managing this uncertainty. Storage and demand-side management have the potential to transform the market and enable the future uncertainty to be managed in a cost-effective manner. To this end, embedded benefits are likely to play an important part in creating the business case for investors to invest in these types of project. A reduction in embedded benefits overall in this important stage of the development of flexible products could set the industry back years.

If you would like to more about our work for the ADE, please contact Andy Pace at andy.pace@cornwallenergy.com**.**