Distributed energy systems abu dhabi

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Distributed generation ("DG") (also called on-site, decentralised, behind-the-meter or embedded generation) is the generation of electricity at or near the point of final consumption, rather than energy transmitted over the electric grid from a large, centralised power generation plant.

DG is typically installed before the meter which is used to measure the consumer"s electricity consumption. It therefore acts to reduce the volume of electricity consumption for which the consumer has to pay the grid tariff.

DG is not new. Countries around the world have allowed or licensed this form of generation for decades. Strong economies of scale in conventional power generation technology have typically meant that electricity from the grid is lower cost and uptake has been limited to consumers who are far from the central network or have non-cost reasons (such as wanting to lower their carbon footprint) for using DG.

Rising retail tariffs, mainly driven by the removal of subsidies, and falling solar and battery costs are rapidly improving the commercial case for DG from solar PV. Figure 1 illustrates this for Dubai.

For an industrial or commercial consumer, the cost of energy from commercial-scale on-site solar generation is lower than the retail tariff. A battery with 2h of storage capacity adds ~$42/MWh, increasing the levelized cost substantially.

However, an LCOE vs. retail price comparison does not tell the whole story. In practice, even with a battery, a distributed system will not always be able to generate when the consumer requires it to. Hourly modelling of the demand and solar profiles is needed to properly understand the business case.

We have used our BID3 power system model to derive the optimal supply mix from PV, battery and grid electricity sources. We modelled several test cases with different combinations of technology cost and grid use (Figure 2).

Case 1 considers a grid-connected consumer seeking only to minimise its costs. In moments where on-site supply is not sufficient to meet demand, the consumer imports from the grid at the standard retail tariff. Battery and PV capital costs are those currently seen in the market.

Case 2 considers a consumer pursuing self-sufficiency. For example, it may want to tell its customers that its energy is "100% from renewable sources". In this case, there is no alternative electricity supply and the customer needs to shed load if on-site supply falls short.

At today"s PV and battery costs, a commercial consumer with a peak demand of ~10MW willing to use a mixture of on-site and grid electricity (Case 1) would optimally build ~12MW of PV capacity, which provides 33% of its energy. 10% of the PV generation is curtailed (wasted). The consumer realises an average cost of $96/MWh - a saving of 18% on the grid tariff.

If the consumer wants to be self-sufficient in electricity (Case 2), a much larger PV capacity (42MW) is needed. This is six times larger than the average demand (7MW). In many hours there is an excess of power which is either wasted (20%) or stored (58%) for later use. A storage capacity of 119MWh is needed, which is equivalent to 17 hours of average demand. This allows the consumer to cover demand during periods where solar output is consistently low and demand is consistently high. Only 1% of the consumer"s demand is not met. The consumer"s overall cost of energy is $149/MWh.

Retail prices have already incentivised C& I-scale and, to a lesser extent, residential-scale investment in places like Dubai and Jordan, but a system perspective suggests that utility-scale projects may offer lower overall costs. As Figure 1 showed, the levelised costs of C& I solar PV projects are higher than for utility-scale projects. Transmission and distribution costs add ~$20/MWh for utility projects, but this does not change the overall picture.

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