Captive Embedded Generation: what happens when utilities fail?

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Abstract

The advancement in electrical battery storage technologies and the decreasing cost of distributed energy have become a major threat to ailing utilities, particularly in high inflation countries such as those in Africa. Globally, utility companies that are still heavily invested in fossil fuel or nuclear base load technologies are struggling to adapt fast enough to the changing energy landscape. Captive embedded generation - now provided by highly efficient and cost-effective solar PV and batteries - threatens to disrupt the whole utility model as consumers start to go entirely off-grid. With no consumers, utilities will ultimately become defunct.

However, there is a silver lining to this dark cloud for utilities. Transporting energy over existing wires is still cheaper than storing it in batteries, and the need for sharing energy between high-consuming buildings with little roof space and low-consuming warehouses with large roof space means that using wires to transport power can result in the most efficient and cost-effective solution for both consumers. This address will explore the options for utilities in the future and what they need to do to adapt to a new energy landscape.

Introduction

The advancement in energy generation, particularly the decreasing costs of distributed renewable energy and battery storage technologies have become a major threat to utilities globally. Utility companies that are still heavily invested in fossil fuel or nuclear base load technologies are struggling to adapt fast enough to the changing energy landscape as cheaper, more flexible energy delivery becomes first choice for consumers.

The picture is no different in South Africa: In 2007, Eskom sold 218 TWh electricity for 18.33c per kwh at a 16.11% profit margin. A decade later in 2017, Eskom sold less power - 214 TWh electricity for 82.66c per kWh at a 0.5% profit margin[1]. For municipal electricity distributors, this picture is not ideal, as they are forced by legislation to buy the majority of their electricity from Eskom.

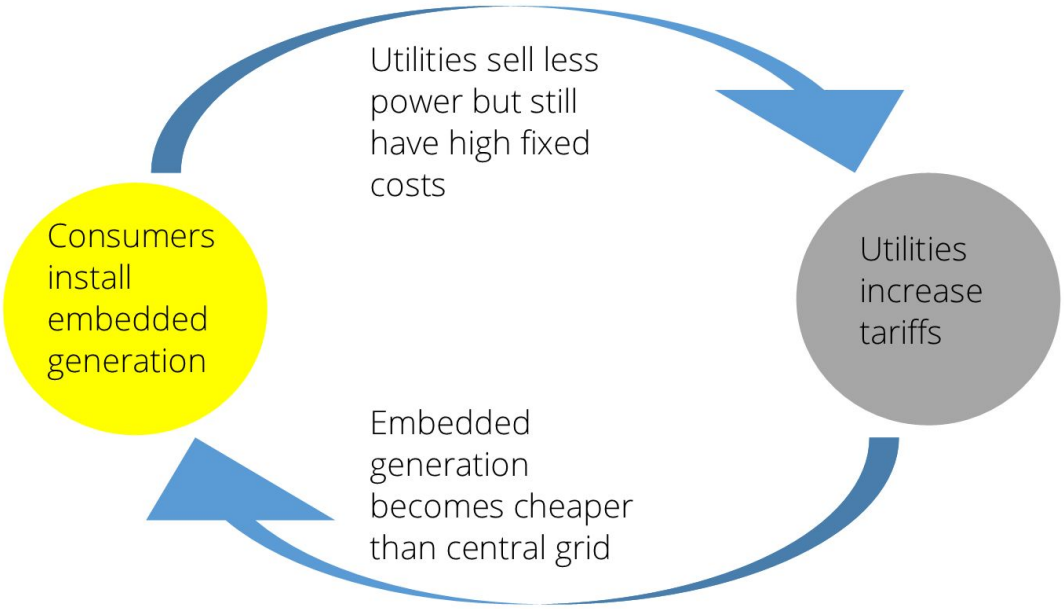
Increasing costs for large utilities is making their customer offering less attractive as the price of alternatives fall. However, utilities can still possess a useful role in society if they adapt to the changing markets.

[1] Eskom AFS, 2017.

Captive Embedded generation and the threat to Utilities

Globally, the prices of renewable energy are falling[2]. Taking solar PV as an example: the costs of solar PV generating technology are such that most consumers of energy in sub-saharan Africa have an opportunity to make immediate savings by supplementing their current supply. Electrical storage batteries follow a similar trend where prices have fallen dramatically over the last 5 years, in some cases up to 70%.

These price reductions trigger what is known as the utility death spiral: as more and more customers lower the energy they consume from utility companies, the utilities experience a loss in profit which they are often forced to compensate by applying tariff increases, further improving the business case for embedded generation sources such as solar PV. This pattern is likely to continue as long as the utility is competing in the generation and retail of electricity without access to the cheapest kWh. Utilities will try and recover the lost revenue through an adjustment in tariff structure, increasing fixed or network related costs rather than variable costs.



Currently, solar PV on its own (even with batteries to store energy at night) is unlikely to be a customer's sole source of generation. The reality is that most residential, commercial and industrial customers will not have the roofspace to generate 100% of their energy needs from solar. These will face a choice whether to continue purchasing from the grid or, if the tariff costs are too high, to consider an off-grid solution,

[2] Renewables 2018 Global Status Report, Ren21, 2018.

introducing gas or diesel engines and battery storage in combination with solar. Already these microgrid projects are beginning to compete with utility prices.

However, there will be other consumers (or just landowners) that have abundance of land or roof space close to an existing network, but low demand to consume the energy locally. For these customers, a micro-grid solution is increasingly attractive particularly as fixed network charges rise. In future the network only becomes attractive to them as a means to sell their product to meet the demand of other consumers. The connection of space-constrained, power hungry customer to the space-abundant, power light customer is where the future utility business model lies.

A utility business case for the future

What does, then, a stable future for utilities look like? As solar and other renewable forms of energy become cheaper and utility energy more expensive, utilities will be able to build a business model by charging for the cost of the energy transportation service using their existing networks.

In fact, there is a strong argument to be made that utilities are better suited to the management and upgrade of their network, than trying to compete in a fast-moving technological race to the cheapest kWh.

Instead of becoming embroiled in a death cycle, utilities can provide a distribution service for generators and customers, including the exact calculation of costs and resources required for only that function (currently generation and cross subsidy of other municipal functions are counted).

A simple example can demonstrate this. Assume that the production costs for the solar generation are A R/kWh, the Consumer is paying B R/kWh for energy from the utility, and Use of System (“Wheeling”) costs are C R/kWh. A business case is created for the solar generator to sell to the Customer when B>A+C, i.e. the customer’s existing tariff is greater than the cost of generating and wheeling the energy. The business case becomes more viable as solar prices drop and utility prices rise, providing more room for a profitable Use of System charge. For utilities this creates a natural hedge against their biggest threat. It also will tempt them to charge as much as they can for C - since no other wires exist and it is unlikely anyone would build more. C requires regulation and a cost plus fixed margin model should be submitted and approved by the national regulator each year. If C is set too high, customers will not want to generate power for export and the case for self generation and grid defection improves.

Local municipal distributors in South Africa, are already to a large extent set up in this model. They purchase electricity from Eskom and distribute it to their customers. There is usually some load balancing generation equipment and network stability services also rendered. The problem for these distributors is that the current legislation in South Africa prevents them from purchasing electricity from other generation sources. The City of Cape Town has taken the Department of Energy to court to fight this legislation in a case that is likely to take several years to conclude.

Most electricity services departments will dismiss the concept of delivering independently produced power to a customer of theirs where the generation facility is elsewhere in the Network. They would rather buy the power themselves - but currently they can't. As an alternative to waiting for the uncertain outcome of this case or a change in legislation, the use of a wheeling framework could assist the municipalities in achieving a similar outcome.

Following from the example above, currently in South Africa, ***B***, is made up of Eskom's Mega-flex price plus a margin applied by the municipal distribution company. Independent Power Producers are at liberty to enter agreements with end users of electricity if they have a generation license. If IPPs can generate a less than Mega-Flex (and most of the REIPPP results show they can) then municipalities can charge the same same margin and still offer their clients a lower cost kWh.

Conclusions

Based on the rapidly reducing costs of renewable, embedded generation of energy, utilities will need to adapt to stay relevant in the shifting energy landscape. However, network operator companies do not necessarily become obsolete in a renewables-focused future. In their possession is a unique asset that, if managed and priced correctly, will encourage customers to remain connected to the network. Offering a Use of Network tariff to allow IPP projects to connect with customers directly offers a natural hedge to falling solar prices and rising utility prices. Distributors can implement these changes within the current legislation in South Africa, and do not have to wait for the result of drawn out legal proceedings in order to implement these changes. If the future of energy is distributed, utilities remain relevant by becoming the distributor, rather than the generator, of energy.