Grid Supporting Functions / UL 1741 SA

New Inverter Requirements to Support a High Percentage Solar Grid

BACKGROUND

When the solar industry first fought the battle to connect to the grid and standardize interconnection requirements in the first edition of IEEE 1547, the utilities mandated that all distributed generation, including solar, comply with extremely narrow windows of operation – if the voltage or frequency strayed outside narrow bounds, inverters were forced to trip offline. In effect, the utility's position was in the event of a grid disturbance for any reason it was "everybody out of the pool." Five minutes after things were back under control and stabilized, inverters could reconnect and get back to business. These narrow windows forced inverters to be "twitchy" and some installations had trouble with nuisance trips, but there was little that installers could do other than attempt to compensate by oversizing feeder conductors.

Perhaps even more importantly, the original IEEE 1547 standard prohibited inverters from helping regulate voltage; inverters were mandated to operate at unity power factor – no matter the needs of the grid, and they were not allowed to modify their output to help stabilize and support the grid. This wasn't a problem in the early days, but as solar and wind have exploded in popularity this becomes a limiting factor as utilities in successful solar regions say their feeders and circuits are reaching limits due to voltage rise. To mitigate this, their options are often limited to imposing interconnection restrictions or increased costs on developers to address hosting capacity constraints.

CURRENT SITUATION

Today, distributed resources like solar and wind are a substantial part of the energy mix in a growing portion of the US. States like California and Hawaii routinely set new records for the percentage of renewable energy provided across the grid. Utilities can no longer afford to have solar trip offline in the event of a grid disturbance – they need all generation to stay online as much as possible, to ride through the disturbance and help clear the fault. In addition, the inverters connected to that solar can provide additional grid supporting functions to help further increase the hosting capacity in a region, to enable even more solar to be interconnected on a given feeder or circuit.

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To address these critical needs, utilities have been changing their grid interconnection standards to allow and even require grid-supporting functions. As a first step, IEEE 1547 was amended in 2014 to remove restrictions against inverters actively participating in voltage regulation and to allow voltage control and disturbance ride-through. At the same time utilities, developers, manufacturers and other industry stakeholders worked collaboratively to define a range of new "Smart Inverter" functions which inverters can provide to support the grid and allow increased percentages of solar, followed by a new expansion of UL 1741 to test and certify these new functions. This new certification is known as UL 1741 SA, or Supplemental Annex.

WHAT IT MEANS GOING FORWARD

Hawaii made ride-through mandatory for all new grid-connected inverters in the Fall of 2016, added a requirement for voltage control at the beginning of 2017, and requires these systems to update their capabilities to provide all the Smart Inverter functions. California adopted these grid supporting "Smart" functions as a requirement for interconnection starting September 8th of 2017. IEEE 1547 is currently undergoing substantial revision to further define and expand grid supporting functions, and is expected to be approved and released by the end of 2017 or early 2018.

As the leading manufacturer focused on integrating solar-plus-storage for grid-interactive systems, OutBack Power has been actively engaged and participating in the development of these new standards. Energy storage can provide considerable depth to grid supporting functions beyond what traditional PV systems can provide alone, but energy storage systems also have unique responsibilities such as resiliency and customer load protection that must be considered. With OutBack's new Grid Interface Protection (GIP) profiles, installers can easily load the correct profile for their utility or region and have all the right settings for their specific application.