

Amperion is a recognized leader of advanced powerline communications solutions for the electric utility industry. Amperion's Distributed Generation solutions are targeted for the Transmission and Distribution utility that integrates generation from Independent Power Producers onto its grid.

## Distributed Generation – Transfer Trip Protection

Distributed Generation (DG) is a fast growing business and a pro-environment option with the majority of Independent Power Producers (IPPs) using renewable sources such as solar and wind.

In order for an IPP to connect to the Electric Grid System an isolation and protection scheme has to be implemented to prevent islanding from occurring.

An islanding case happens when there is a break on a section of the grid between the substation and the Distributed Generation facility. When this happens the connected DG can create a number of problems:

- Islanding creates a potential hazard for utility line-workers and the public by causing a line, assumed to be disconnected from the main power grid, to still be energized by the DG.
- Without an effective islanding detection system, the distributed generator can become overloaded when forced to power the isolated line.
- The DG can be damaged when reconnected to the main power grid after being islanded. DG's are unlikely to be synchronized with the system at the instant of reconnection. Such out-of-phase reclosing can inject massive current to the DG causing damage.
- While islanded, the DG will produce incorrect voltage and frequency to other power users connected to the power line near the DG, which can damage equipment and pose responsibility issues and repair cost liabilities.

The IEEE 1547 standard requires that DG sites go offline within 2 seconds from detection of an islanding condition. This is signaled by a Transfer Trip (TT) command to the breaker at the DG site to trip (open) and physically disconnect from the line. Sending a TT command requires a reliable and cost-effective communications link between the utility and the DG site to detect and protect against this situation.

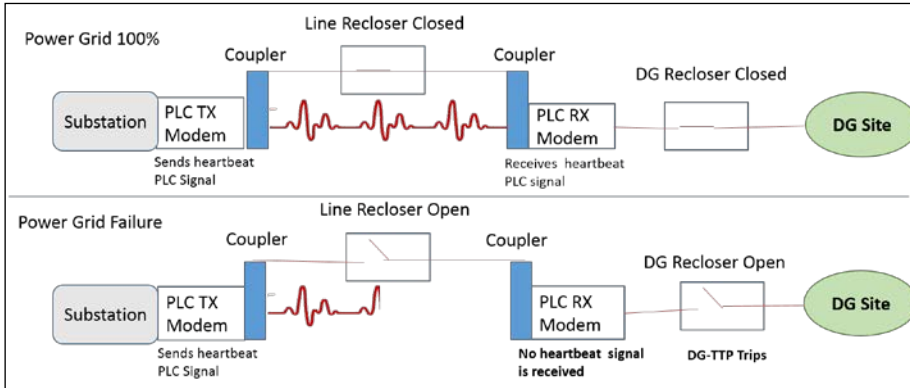
Non-PLC communications technologies such as dedicated fiber optics, copper phone lines, and wireless radios, all require a two-step process:

- (1) islanding detection and
- (2) sending a transfer trip command to open the interconnection point.

A physical device is required on each pole that has a line recloser in order to monitor its state and report an islanding condition. A separate device transmits the transfer trip from the substation to a receiver at the DG interconnection point. The high number of devices results in a costly solution and every change of reclosers on the line require a re-configuration of the protection system.

## Amperion DG-TTP

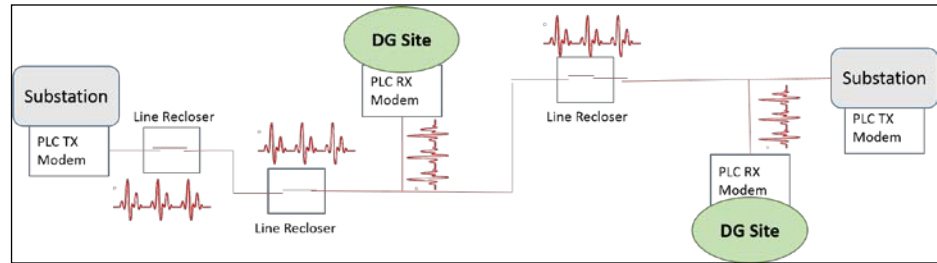
The Amperion DG-TTP is based on Power Line Carrier and is comprised of two components:



- **DG-TTP-TX** - a transmitter that is installed in the substation and tuned to a specific PLC frequency.
- **DG-TTP-RX** – a receiver that is installed in the DG site and connected to the recloser controls.

The DG-TTP generates a “Heart Beat” signal between the TX and RX and the lack of signal detection by the RX will cause it to trip the DG recloser and take the DG site offline within 2 seconds.

The DG-TTP signal always travels from the substation to the DG site and is independent of the number of line reclosers along the path as well as the number of DG sites connected to a substation.



Anti-islanding detection now becomes the detection of signal continuity from the substation to the DG location with the power line used as the signal carrier. As a result, DG-TTP is a single step solution that works equally well for feeders with multiple reclosers, providing a significantly simpler solution than any other available today. One signal generator is sufficient to cover all DG’s served by a substation.

DG-TTP allows for multiple substations to be connected to a DG site. Each substation uses a different frequency to uniquely identify itself and the path to the DG site. The receiver at the DG site can easily know where the islanding condition occurred based on the lack of that specific frequency signal.

DG-TTP is immune to the impact of feeder reconfiguration unlike non PLC based solutions that require reconfiguration for every change. DG-TTP is a fail-safe scheme and gives utilities a full control on DG trip. The utility has full control over the DG connection – It can trip a DG by simply stopping the broadcasting of the signal from the substation.

## DG-TTP Summary

The Amperion DG-TTP provides a solution for controlling the connection of a Distributed Generation site to the electric grid that is:

- extremely reliable
- cost effective
- easy to install and maintain
- conforms to IEEE 1547 standard