Types of grid tie inverters

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A grid-tie inverter converts direct current (DC) into an alternating current (AC) suitable for injecting into an electrical power grid, at the same voltage and frequency of that power grid. Grid-tie inverters are used between local electrical power generators: solar panel, wind turbine, hydro-electric, and the grid. [1]

With net metering the electricity company pays for the net power injected into the grid, as recorded by a meter on the customer''s premises. For example, a customer may consume 400 kilowatt-hours over a month and may return 500 kilowatt-hours to the grid in the same month. In this case the electricity company would pay for the 100 kilowatt hours balance of power fed back into the grid. In the US, net metering policies vary by jurisdiction.

Grid-tie inverters are designed to disconnect quickly from the grid if the utility grid goes down. In the United States, there is an NEC requirement[2] that in the event of a blackout, the grid tie inverter shut down to prevent the electricity it generates from harming persons repairing the power grid.

Properly configured, a grid tie inverter enables a building to use an alternative power generation system such as solar or wind power without extensive rewiring and without batteries. If the system produces insufficient power, the utility grid makes up the deficit.

Grid-tie inverters include conventional low-frequency types with transformer coupling, newer high-frequency types, also with transformer coupling, and transformerless types.[3] Instead of converting direct current directly into AC suitable for the grid, high-frequency transformers types use a computer process to convert the power to a high-frequency and then back to DC and then to the final AC output voltage suitable for the grid.[4]

Transformerless inverters, which are popular in Europe, are lighter, smaller, and more efficient than inverters with transformers. But transformerless inverters have been slow to enter the US market because of concerns that transformerless inverters, which do not have galvanic isolation between the DC side and grid, could inject dangerous DC voltages and currents into the grid under fault conditions.[5]

However, since 2005, the NFPA''s NEC allows transformerless, or non-galvanically isolated, inverters by removing the requirement that all solar electric systems be negative grounded and specifying new safety requirements. Amendments to VDE 0126-1-1 and IEC 6210 define the design and procedures needed for such systems: primarily, ground current measurement and DC to grid isolation tests.

Central to the success of solar power systems are grid tie solar inverters, sophisticated devices that facilitate the seamless integration of solar-generated electricity into the existing electrical grid. These solar inverters serve as the bridge between solar panels and the grid, converting the direct current (DC) electricity produced by the panels into alternating current (AC) electricity that can be used to power homes, businesses, and industries.

Essentially, a grid tie solar inverter is a device that converts the direct current (DC) electricity generated by solar panels into alternating current (AC) electricity that can be fed into the electrical grid.

Solar panels mounted on the roof or in an open area absorb sunlight and convert it into DC electricity. This DC electricity then flows into the grid tie solar inverter, where it undergoes a process called inversion.

During inversion, the DC electricity is converted into AC electricity. This is achieved through a series of electronic components within the inverter, including transistors and capacitors, which manipulate the flow of electrical current to produce the desired output. Once the electricity has been converted, it is synchronized with the frequency and voltage of the utility grid, allowing it to seamlessly integrate with the existing electrical infrastructure.

Maximum Power Point Tracking (MPPT) Controller: Monitors the output of the solar panels and automatically adjusts the inverter"s operating state to ensure the system is always running at the maximum power point.

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