solis seminars

Episode 37

Key Considerations of Inverter Selection in Building Integrated Photovoltaic (BIPV) Projects

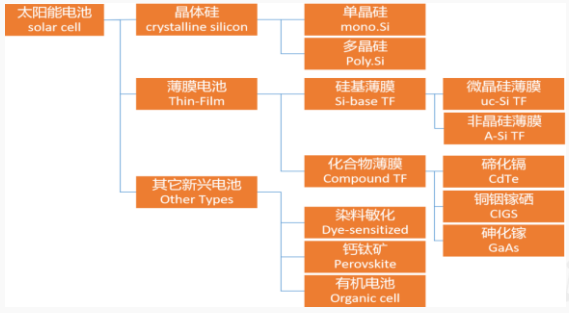
Background

To further address climate change, promote the development of energy saving and carbon reduction, buildings will be the focus follow-up new energy development. The organic combination of a solar PV system and buildings makes it simple and practical to create green buildings with a reduced carbon emissions profile. BIPV installations also ensure the design of any new build is considering it's energy profile from the outset in order to deliver more aesthetically pleasing architecture.

This Solis seminar will share the characteristics of BIPV projects and the key points of inverter selection.

BIPV Project Characteristics

In a BIPV project, it is necessary to design the solar PV system according to the structural characteristics of the building itself. Often the roof area of some buildings is not sufficient and in addition, other areas of the building need to be used. This can include solar curtain walls, daylighting roofs, shading, etc.



Due to the aesthetic needs of BIPV projects, solar panels are more biased towards power-generating glass, double-glass cells and thin-film cells. Thin-film cells have excellent light transmittance and aesthetics, perform better under low-light conditions, and have better scattered light absorption performance. The curtain wall BIPV solution is possibly the most mainstream choice. Thin film modules mainly consist of copper indium gallium selenium (CIGS), cadmium telluride (CdTe), perovskite (PSC) and other such material types. These different material routes are better suited to different schemes and usually when the design is driving the inverter configuration.

In addition, because a BIPV project has a complex structure and diverse orientations, especially projects that combine multiple application forms, it is necessary to fully consider the project structure, electrical, and safety issues when designing the PV system.

BIPV Project Inverter Selection

The main features of a BIPV project can vary. There are many architectural application scenarios, such as flat roofs, inclined roofs, curtain walls, transparent roofs, sunshades, etc. In addition, the inclination angle can be complex and the selection of materials diverse, so the following issues must be considered when choosing an inverter.

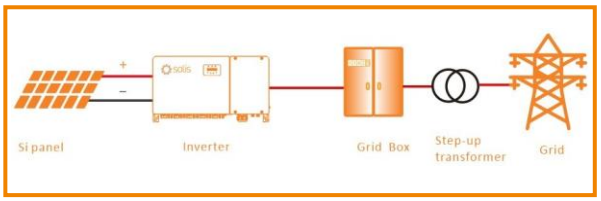
BIPV Projects Perfectly Suit String Inverters

The orientation, inclination, and component selection of a BIPV project can be complex and diverse. You should try to choose a string inverter with multiple MPPTs, so that the PV system has a better maximum power tracking advantage, and effectively copes with the above-mentioned challenges.

Solar Panels of Different Types & Materials Need a Compatible Inverter

In a BIPV project, due to the requirements of aesthetics, different building areas will use different PV panels. For example, flat roofs use crystalline silicon panels, light-transmitting areas use photovoltaic power generation glass, and walls use thin-film PV panels. Therefore, it is necessary to select a suitable inverter for configuration according to the selected solar panel materials.

If the material is a crystalline silicon component or a cadmium telluride thin-film PV panel, you can use a photovoltaic inverter with a transformerless topology and configure it in accordance with the conventional method.



If the PV panel uses a thin-film cell that requires negative grounding, since the panel is grounded negatively, the possibility of DC leakage and the potential safety hazards of electric shock for personnel are increased. In this instance it is recommended to use an inverter with a high-frequency transformer topology.

The alternative is to install a transformerless inverter PLUS power frequency transformer solution.

Configuration Using an Inverter with High Frequency Transformer Topology

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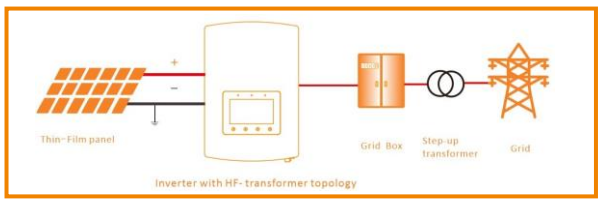


Advantages:

-No need to connect an external power frequency transformer

-Simple to install

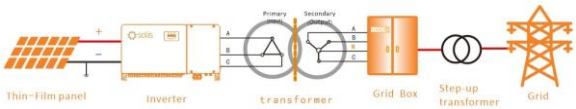
Disadvantages:

-Inverters with high-frequency isolation topology aren't common, making it more difficult to source

-Internal isolation transformer power limitation makes it impossible to realize a single high-power product. This may lead to difficulties in the configuration of large-scale projects

-Due to the internal transformer, inverter efficiency is low

Configuration using Transformerless Topology Inverter + Power Frequency Transformer



For inverters with transformerless topology, in a thin-film PV panel solution, a frequency transformer must be processed at the output end. The primary of the transformer is not grounded and three-phase transformers are recommended to use the "△, Y" connection method, and the end closest to the inverter is "△" .

The terminal of the distribution box is a "Y" type connection and the neutral point can be connected or not (according to the actual situation of the site). The inverter is then connected to the protective ground, and there is no electrical grounding. Capacity is recommended to be 1.1 times the rated capacity of the inverter.

Advantages:

-Transformerless inverters are common, easy to purchase, and relatively low cost.

-Transformerless inverters are widely used globally, from 700W to 320kW.

-System configuration and product selection is simple.

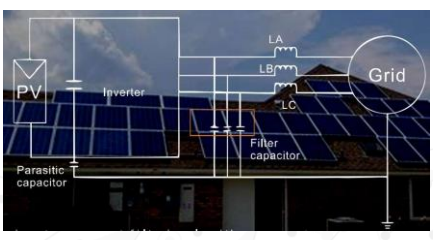
Disadvantages:

-An external frequency isolation transformer is required.

The Chosen Inverter Should Have a Strong Current Leakage Suppression Function

Since most BIPV projects use thin-film PV panels, the distance between the solar panels and the mounting is close, so the capacitance to ground is greater, and the current leakage is larger. If the substrate is metal, the surface of the metal foil is large and thin, and the current leakage to the ground will be greater.

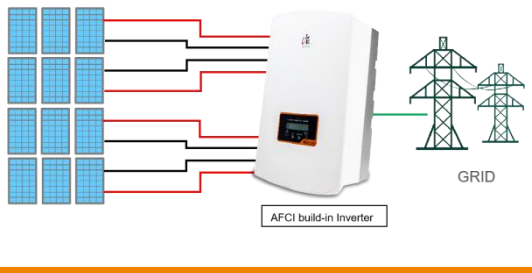
Even if negative grounding is used, there will be current leakage problems which will affect the safety and performance of the system.



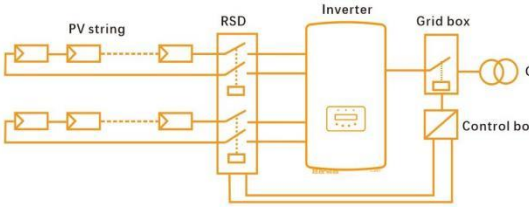
The selected inverter products need strong current leakage suppression functionality.

The Inverter Must Have Active Safety Protection and Supporting Functions

For PV systems applied to buildings, safety protection is vital, especially regarding fire hazard functions. Therefore, inverters must have supporting functions such as Arc-Fault Circuit Interruption (AFCI) and Rapid Shut Down (RSD) to achieve full system protection and subsequent safe operation and maintenance.



Inverter with AFCI function



Supporting RSD functional products

The Inverter Should Have a Dedicated Online O&M Platform

BIPV projects are designed in combination with architectural characteristics. Therefore, compared with traditional photovoltaic projects, its later operation and maintenance (O&M) can be more difficult and costly. Choosing inverter products that deliver a wealth of online operation and maintenance tools ensure the system delivers intelligent, convenient O&M.

Conclusion

BIPV project products make full use of the area of the building, which can effectively increase the power per unit area by 60%. The development of green buildings is of great significance to society's energy saving and emission reduction. BIPV is undoubtedly one of the key directions of solar development and it is essential to choose suitable inverters based on the individual characteristics of the installation.