Solar Panel Specification for Commercial & Industrial Projects

A Focus on Building Integrated Photovoltaics

alspec solar

By replacing conventional building materials, BIPV systems help minimise waste and material costs and streamline the construction process.

INTRODUCTION

As the global shift towards renewable energy intensifies, the deployment of solar panels is emerging as a key trend in sustainable design. Pioneered in Australia, solar panels have become the most popular renewable energy technology, with their deployment rapidly expanding worldwide. This progress owes much to Australian research, particularly the work of Dr. Martin Green and his team at the University of New South Wales, who took solar panel technology out of the lab and into the market, setting the benchmark for solar panel efficiency and affordability.

Solar panel systems work by using photovoltaic (PV) cells within the panels to convert sunlight into electricity. The transition to solar energy is increasingly attractive for businesses, driven by substantial environmental and financial benefits, including improved energy security, compliance with local planning regulations, and support for sustainable building certifications such as BREEAM and NABERS.

Solar panel systems can have a sizeable initial capital expenditure, but the payback period usually lasts only between two and five years. Ongoing innovations, government incentives and rising production in the solar sector are making solar energy an even more affordable and dependable choice. However, one drawback is that traditional solar panels can be difficult to install and often disrupt the design of a building.

In this whitepaper, we focus on the specification of building integrated photovoltaics (BIPVs). These types of solar panel systems are unique in that they are modules that are built into the building envelope, replacing conventional building materials, thus becoming an integral part of the architectural design. Design considerations for BIPV frequently centre on lightweight applications and seamless integration into building structures, maximising both functionality and aesthetics.

UNDERSTANDING BIPVS

A major obstacle in the application of solar technology is ensuring the structural integrity of buildings. Many existing structures may not be able to support the weight of traditional solar panels, which can be as heavy as 27 kg per panel depending on the manufacturer, without additional reinforcement. Installation may require expensive structural changes, which could be a barrier to widespread adoption.

In addition, the design of traditional solar panels can clash with a building's architectural aesthetics. The structure that supports the panels can be easily seen, even from the ground, and the panels themselves are not very discrete. Some people may hesitate to install solar panel systems because they think they will be an eye sore that takes away from the visual appeal of their building.

Overcoming these issues, modern BIPV systems are, to put it simply, solar building materials; they are roofs, tiles, windows or facades that serve as an outer layer for the structure while generating electricity for on-site use or export to the grid. By providing good architectural aesthetics, opportunities for integration and exceptional performance, BIPV systems can help progress the widespread adoption of solar energy technology.

Examples of BIPV components and materials currently on the market include the following products from Alspec Solar:

- **Galaxy Series** is a featherlight BIPV product designed for industrial, commercial and residential applications. It is ideal for low load-bearing and poor waterproofing roofs while ensuring power generation efficiency.
- **Polaris Series** allows you to replace the roof of structures with solar panels, such as carports, flat-to-sloping roofs, patio systems and sheds.
- **Sunshine Series** is an integrated solar roof tile solution for pitched rooftops to replace traditional solar panels and framework.
- **Starlux Series** is an integrated glazed PV panel, which is ideal for glass houses, green rooms, patios and winter gardens.

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WHAT ARE THE ADVANTAGES OF BIPVS?

Since architects are responsible for the design of buildings, it is important that they understand the opportunities that BIPV systems offer in order to effectively explain them to clients.

While they can be retrofitted to existing buildings, the advantages of BIPV systems are most evident in new builds. By replacing conventional building materials, BIPV systems help minimise waste and material costs. They also streamline the construction process. For example, the design issues for separate mounting systems are eliminated. In addition, their lightweight design addresses many structural limitations and offers increased installation flexibility and faster construction times compared to traditional panels.

This innovative approach not only accelerates the adoption of solar technology but also supports sustainable building practices. BIPV systems not only generate clean electricity on-site without requiring extra physical space, but they can also reduce cooling loads and maximise daylighting to reduce a building's energy consumption.

BIPV systems essentially turn roofs and facades into energy-producing assets. A recent study noted that BIPV systems as a building envelope material for the whole building could recoup not only all the investment costs but also become a source of income for the building.[1]

Finally, BIPV systems offer architects and designers unique opportunities to enhance a building's visual appeal. For example, BIPV roof tiles can take the place of traditional roofing materials and blend in perfectly with the exterior of the building.

DESIGN AND INSTALLATION

Initial considerations

During the planning and design phase, it is essential to consider both lifecycle costs and upfront expenses of BIPV systems, along with installation procedures and performance expectations. For commercial buildings, which often have larger roofs and higher energy needs, BIPV systems offer significant benefits in terms of energy savings and alignment with corporate Environmental Social Governance (ESG) goals.

However, due to the scale and complexity of commercial operations, commercial solar systems often require more complex design, installation, and integration. Solutions like the Galaxy Series can streamline the process with their non-penetrative installation methods that eliminate the risk of roof damage.

Additionally, integrating BIPV into a building's design must address aesthetic considerations to ensure that the system enhances both the visual appeal and functionality of the structure. It is easier to achieve a cohesive design by considering aesthetics early in the design process.

System components

In general, the two key components of a solar panel system are: solar panels that capture energy from the sun; and inverters that convert solar energy into usable energy. Other components may include performance monitoring tools that allow you to track the amount of energy the solar panels are generating, solar batteries that store excess electricity for later use, and the requisite cabling and wiring.

Location and orientation

The efficiency of a solar array is greatly impacted by site conditions, including climate and environmental factors. To get the best results, it is imperative to make sure the panels are exposed to the maximum amount of sunlight possible without being blocked by surrounding structures or trees. As a general rule, to generate the most energy all year round in the southern hemisphere, install the solar modules facing north. In addition, the orientation and tilt of the array must be carefully calculated, as these factors have a direct impact on the system's annual energy production.

Almost any external surface can be a potential installation site for BIPV systems. For example, the **Galaxy Series** is well-suited for low load-bearing roofing conditions, while the **Sunshine Series** offers an integrated solar roof tile option for pitched rooftops, replacing traditional panels and frameworks. **Polaris** works well on flat-to-sloping roofs. As it is an integrated glazed panel with some translucency, the **Starlux** system can be applied to the roofs over outdoor living areas.

System size and performance requirements

A solar panel system's capacity is expressed in kilowatts (kW). Kilowatt hours (kWh) represent the total amount of energy produced over a given period of time. Typically, commercial and industrial installations are rated between 10 and 100 kW.[2]

Many projects aim to achieve Green Building Certificates, targeting 6 or 7-star ratings as part of their ESG initiatives. The solar panel system needs to be designed to accommodate the building's specific energy needs and performance goals, with consideration of the amount of physical roof space available, the amount of expected sunlight for the location, and financial constraints.

Weight of system

The weight loading of solar panels and their installation methods can significantly impact the structural integrity of the building. For traditional solar panels, you will need to carefully consider the weight limit of the roof to avoid damage or collapse. This risk is eliminated by some of the most advanced lightweight BIPV systems. For example, the **Galaxy Series** offers an ultra-lightweight design at just 5.6 kg/m^2, which minimises the load on the roof and reduces the need for extensive structural modifications.

Ventilation

Elevated operating temperatures can significantly reduce the efficiency of solar modules, as increased temperatures lead to lower voltage and power output. Maintaining sufficient ventilation and airflow around the panels assists in heat dissipation, keeping the modules cooler and improving energy efficiency.

Using BIPV as integrated shading

BIPV systems can be integrated into skylights, roofing, facades, or glass areas to create an effective shading solution that also produces energy. This dual function improves the energy efficiency of the building by lowering unnecessary cooling loads and glare from large glass surfaces, as well as making the interior environment more comfortable for occupants.

Aesthetic considerations

BIPV systems can be made to resemble common elements like glass, roofing tiles, and cladding materials, so they can be made to naturally fit in with the architectural style of the building. Solar roof tiles, for example, can be used in place of traditional tiles while complementing or matching the colour and texture of the surrounding materials. Similarly, BIPV glass can be integrated into windows or curtain walls, maintaining transparency and visual continuity.

Introducing Alspec Solar: Redefining solar energy solutions

Alspec Solar goes beyond the traditional approach by focusing on advanced BIPV solutions that seamlessly merge solar panel technology with architectural elements like cladding and roofing systems. By blending solar technology with the building's facade, Alspec Solar creates a cohesive and visually appealing design that complements the overall architecture.

Alspec Solar continues to push the boundaries of innovation with their advanced BIPV technology. Their approach delivers a seamless, smart, and cost-efficient solution for commercial, industrial, and residential projects. Whether it's the ultra-lightweight **Galaxy Series** panels, the versatile **Polaris Series**, the integrated roof tiles of the **Sunshine Series**, or the transparent glazed panel of the **Starlux series**, Alspec offers products designed to meet diverse needs. With the support of their dedicated technical team, clients can confidently transition to sustainable energy solutions, knowing they have the expertise and resources to ensure a smooth implementation.

One of the key advantages of Alspec Solar's approach is the simplification of the design and construction process. By offering both architectural components and solar integration under one roof, Alspec Solar allows architects and designers to work with a single supplier, streamlining the entire project. This integrated expertise ensures that solar systems are effectively incorporated into the building's design, reducing the complexities typically associated with coordinating multiple suppliers and ensuring a smoother construction process.

A real-world success

Alspec Solar is turning to its own solar PV technology as the ideal alternative energy solution for its journey towards reducing its environmental impact. Each Alspec facility, from urban sites to regional offices, will be fitted with state-of-the-art solar panels, customised to suit the specific energy needs and architectural designs of each site.

At their Sydney Headquarters and Distribution facility, a 99.5kW Alspec Solar 315W Galaxy Series System was installed, covering 569 m^2 of roof space. Paired with a 100 kW string inverter, the system is designed to meet 20% of Alspec Solar's electricity demands for production and operations.

Installing the Alspec Solar lightweight panels takes only 3.5 days, compared to 7 days for a conventional 100 kW system. The lightweight panels, coupled with a no-drill, easy installation method, ensured that the roof remained undamaged during the process.

In another significant step, Alspec installed a new 400kW solar system with the 335W Alspec Solar Galaxy Series panels at its headquarters. This solution delivers approximately 100% energy cost savings and only took two weeks to install, illustrating the advantages of lightweight solar panel systems.

In Australia's architectural and design scene, the introduction of Alspec Solar is a significant development. Alspec Solar gives architects and designers the tools they need to design buildings that are not only aesthetically beautiful and functional but also environmentally friendly by providing a comprehensive approach to solar building envelopes.

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All information provided correct as of September 2024