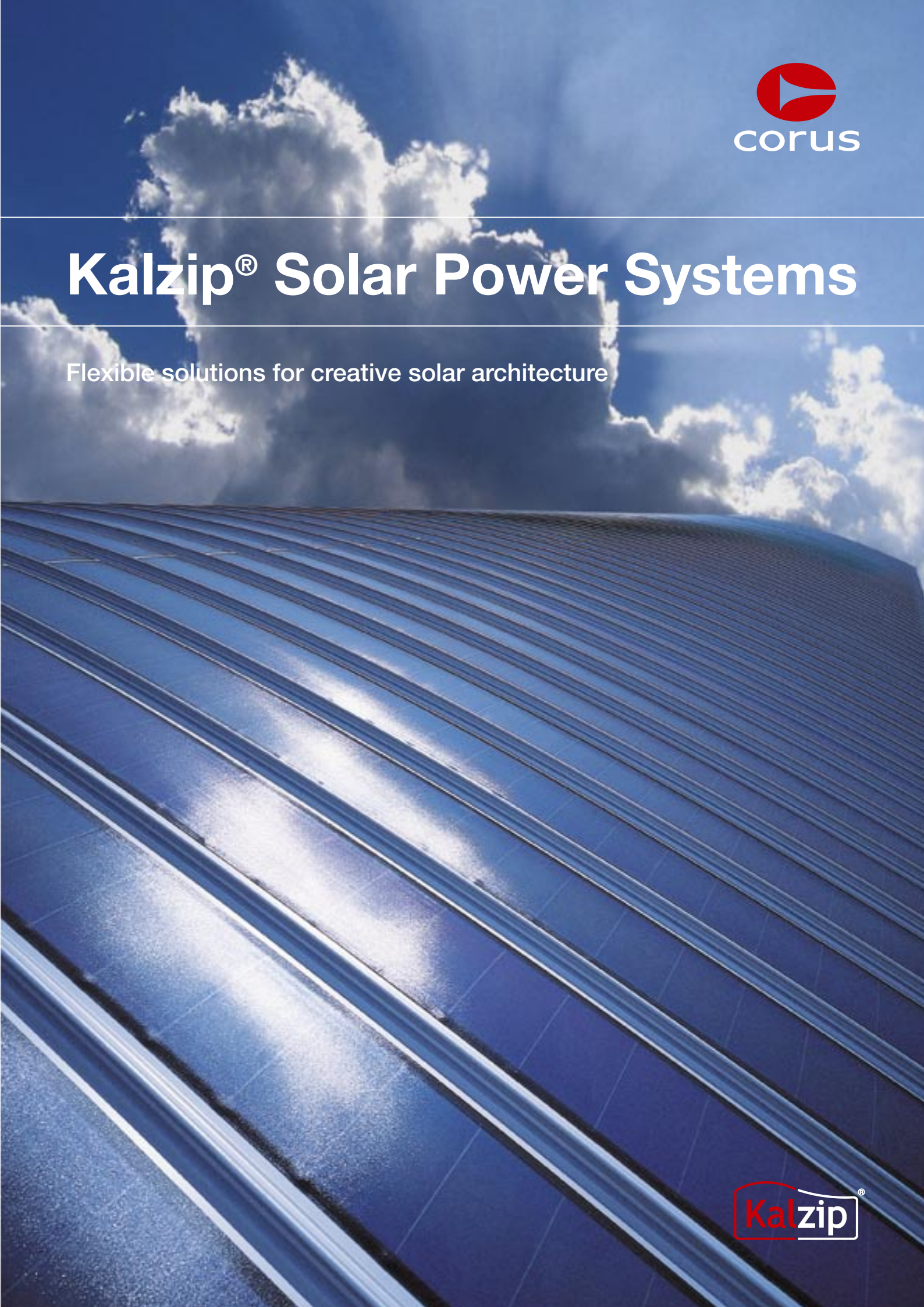
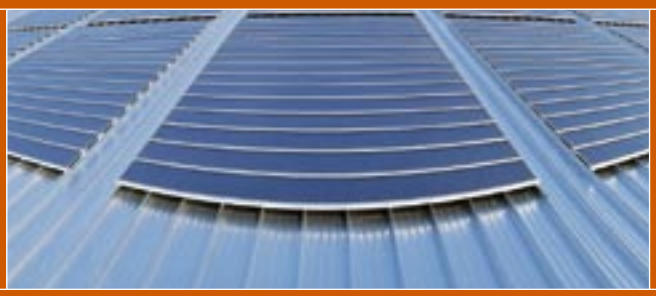

corus
Kalzip® Solar Power Systems
Flexible solutions for creative solar architecture
Kalzip®

Kalzip®
Solar Power Systems
The synthesis of design and function



Freedom of creativity for environmentally conscious designers and architects

Our partner for triple-junction technology:

UNI-SOLAR
United Solar Ovonic

Responsibility is a keyword in contemporary architecture. The creation of new buildings is a practice which benefits future generations, and today also includes the implementation of ecological value systems.

The introduction of Solar Photovoltaic (PV) into the building envelope is no longer determined by the mere functionality, but is implemented as an integral part of the building form.

The flexibility of Kalzip® roof systems provides the designer with maximum freedom of creativity; this allows optimal realisation of dedicated architectural concepts for aesthetic solar design.

The longevity of Kalzip® roof systems, together with the performance warranty on the solar laminates, make Kalzip® Solar Power Systems both profitable and in tune with the requirements of modern solar architecture.

Above: Three-court school in **Frechen (Germany)**
Architect: Reich

Page 6: IC-Haus in **Bodenheim (Germany)**
Architect: Dorberth-Kraus

Page 7: Schiller School in **Bretten (Germany)**

With Kalzip® Solar Power Systems, you fulfill the prerequisites of sustainable construction.

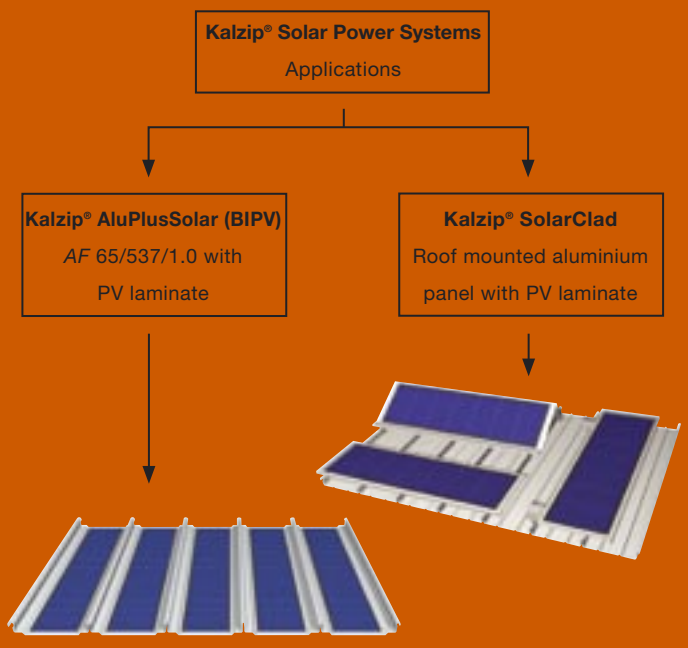
Kalzip® Solar Power Systems were developed in the interests of environmental protection and the conservation of resources. Kalzip® standing seam roof sheets are the ideal substrate for PV systems on new buildings and renovated roofs, as well as when retrofitting. A further alternative of power generation is the integration of PV systems into the building envelope.

Under diffused light conditions, the silicon thin-film solar cells in the innovative triple-junction technology developed by our partner UNI-SOLAR reach a greater energy yield than crystalline solar cells of the same rated power output. This makes them ideal for installation in all European regions.

When referring to PV systems, architects make a distinction between roof-mounted and roof-integrated (BIPV) systems. Corus Bausysteme offers solutions for both options which are optimized for Kalzip®roof systems

For individual freedom of design, and the simultaneous use of solar energy, Kalzip® AluPlusSolar offers interesting prospects by means of a combination of extremely robust PV laminates and Kalzip® profiled sheets, even making convex and concave constructions possible.

Kalzip® SolarClad is suitable for the design and installation of PV laminates onto existing structures. The roof mounted solution can be clamped to any Kalzip® standing seam profile and accommodates the architectural requirements relating to building shape.



Solar construction gives shape to a new aesthetic. Architects set trends with Kalzip® AluPlusSolar.

The new Kalzip® AluPlusSolar panels are the first to enable truly roof-integrated renewable power generation using flexible PV laminates, while providing maximum freedom of creativity for challenging object architecture.

A wide variety of designs can be accomodated, as the solar laminate is permanently attached to Kalzip® aluminum standing seam sheets. This integrate system allows individuality of roof design incorporating straight, convex, or concave shapes. Without mounting frames, the solar cells are in plane with the roof surface and yet convey an independent, expressive character.

Typical constructions such as shed or barrel vault roofs are also possible, at pitches of up to 60°.

Kalzip® SolarClad: design flexibility and low weight.
New possibilities for sustainable construction.

Kalzip® SolarClad is a PV system optimised for use on metal roofing. Its flexibility and versatility enable solar panels to be integrated into almost any standing seam system.

Kalzip® SolarClad is a retro-fit solar solution which can be integrated into the building structure and which is predestined for the utilization of this energy type, whether in installations on existing structures or when planning new buildings.

The PV laminates consist of extremely robust amorphous silicon (a-Si) thin-film cells attached to aluminum carrier panels, which can be installed on any typical standing seam system without penetrating the roof. SolarClad can be conventionally mounted on other system elements, such as trapezoidal sheets. The additional loadings are only slight, due to the low weight per unit area of between 3 and 7 kg/m².

The lightweight panels are suitable for all roof shapes and guarantee architects maximum freedom of design.

Kalzip® AluPlusSolar
Roof-integrated, renewable power generation for aesthetic solar architecture.

The combination of thin-film solar laminates with the properties of Kalzip® roof systems provides architects and designers of photovoltaic systems maximum freedom of design while making efficient use of solar energy.

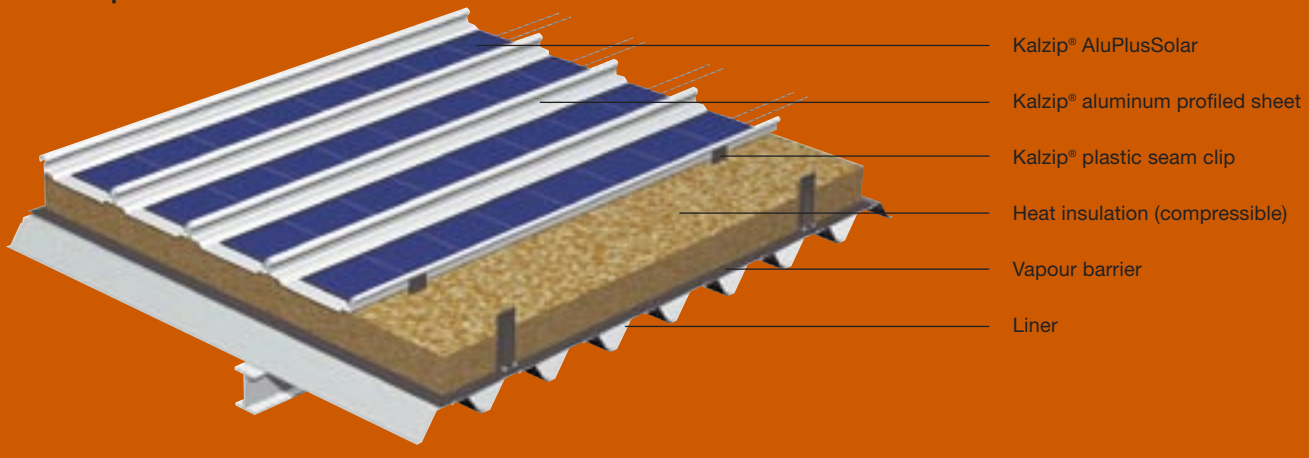
Kalzip® AluPlusSolar is offered as an all-in-one system including inverter and accessories.

Dimensions of Kalzip® AluPlusSolar	*AF* 65/537 mm
Sheet thickness	1.0 mm
Surface	RAL 9006
Weight	Approx. 7.0 kg/m² (incl. solar laminates)

An overview of the product's advantages

- Aesthetic, roof-integrated photovoltaic system, without additional fasteners
- Ideal for challenging architecture
- Optimal utilisation of solar energy even in poor light conditions by means of triple-junction technology
- Higher shading tolerance than crystalline modules, due to tight bypass circuitry
- Economical due to high performance warranty (20 years)
- Suitable for cold or warm roof design
- Self-cleaning surface – therefore minimum maintenance requirements

Example of a roof structure with Kalzip® AluPlusSolar



Kalzip® SolarClad
The retro-fit solution for all metal roofs – light and flexible.

Kalzip® SolarClad is suitable for all roof shapes up to a 60° pitch. Its low weight generally means that there are no additional structural requirements for the roof.

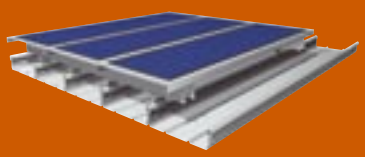
Kalzip® SolarClad is offered as an all-in-one system, including inverter, for various standing seam profiles and can be delivered in two lengths, laminated onto carrier panels and ready for connection.

An overview of the product's advantages

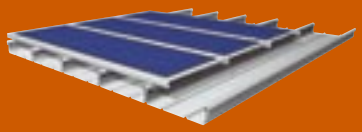
- Amorphous thin-film laminates for lasting efficient utilization
- Up to 20% higher energy yields than crystalline modules due to triple-junction technology
- High shading tolerance due to tight bypass circuitry
- Low weight between 4 kg/m² and 8 kg/m², including fasteners
- Suitable for all standing seam systems and varieties due to variable fastening system
- Cost-effective PV solution for new building projects with Kalzip® standard overall widths
- High economic efficiency due to quick, non-penetrative installation
- Environmentally friendly due to short energy payback time < 3 years
- Simple structural calculations for Kalzip® roofs
- Improved heat protection in summer due to roof shading
- Many different installation options for maximum power density and optimized yields
- Ideal for all roof shapes, contour-hugging for barrel vault roofs of up to a minimum 13 m radius

Installation options:

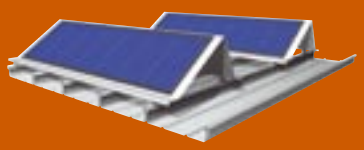
Roof-parallel longitudinally mounted onto Kalzip® aluminum profiled sheets



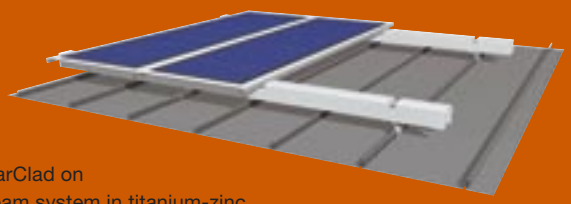
Roof-parallel transversa-ly mounted onto Kalzip® aluminum profiled sheets



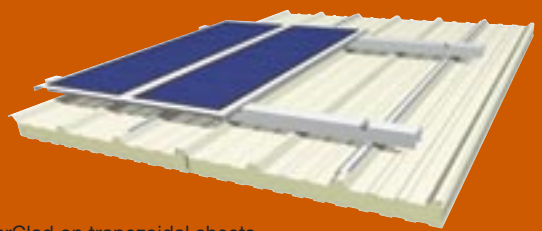
Tilted mounting onto Kalzip® aluminum profiled sheets



Retrofit solutions



Kalzip® SolarClad on standing seam system in titanium-zinc



Kalzip® SolarClad on trapezoidal sheets

Technical data

The solar laminates (available in two lengths) acts as a solar generator and is laminated onto Kalzip® in the factory ready for connection on site. Kalzip® Solar Power Systems are available with both photovoltaic thin-film solar laminates PVL-68 and PVL-136, which have power outputs of 68 and 136 kWp respectively.

	PVL-68	PVL-136
Required area per kWp **Kalzip® AluPlusSolar** [m²]		from 22
Required area per kWp **Kalzip® SolarClad** (roof-parallel installation) [m²]	> 18.50	> 18.50
Module length [m]	2.85	5.50
Rated power output [W]	68	136
Operating voltage V_{MPP} [V]	16.5	33.0
Operating current I_{MPP} [A]	4.13	4.13
Open-circuit voltage V_{OC} [V]	23.1	46.2
Open-circuit voltage V_{OC} at -10 °C and 1250 W/m² [V]	26.3	52.7
Short-circuit current I_{SC} [A]	5.1	5.1
Short-circuit current I_{SC} at 75 °C and 1250 W/m² [A]	6.7	6.7
Fuse in series, nom./blocking diode, nom. [A]	8.0	8.0
Maximum DC system voltage [V]	1000	1000

Note: The above values (± 5%) are stabilised values. During the first 8 to 10 weeks of operation, system power, operating voltage, and operating current may be 15%, 11%, and 4% higher respectively.

Kalzip® Solar Power Systems satisfy protection class II requirements, design qualification and type approval in accordance with IEC 61646.
TÜV Rheinland, Cologne

Corus Bausysteme offers you an optional large solar display unit which clearly indicates the current system power output, the energy yield and the CO_2 savings in a clearly visible manner.

Kalzip® AluPlusSolar planning notes:
- Minimum radius in the area of the laminate-covered sheets > 13m
- Roof pitch min 3°, max 60°
- Fixing and electrical installation to be completed according to Kalzip® Solar Power Systems installation instructions

Kalzip® SolarClad planning notes
- Suitable for all Kalzip® profiles
- Fixing and electrical installation to be completed according to Kalzip® Solar Power Systems installation instructions

Strong partners: roof renovation using lightweight steel structures combined with Kalzip® Solar Power Systems.

Every year, large sums of money are spent on the repair and maintenance of failing flat roofs.

The Kalzip® renovation concept using lightweight steel construction is a system developed to ensure sustainable building protection. Without interruption to occupant activity, complete roof environments can be economically and lastingly renovated.

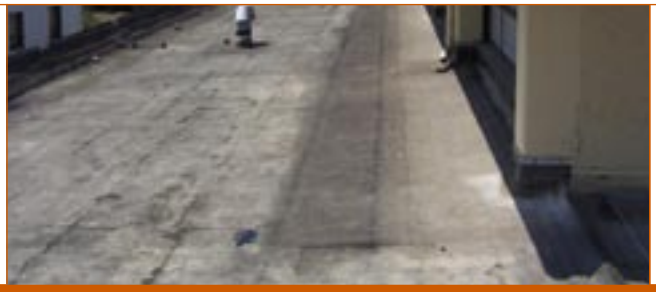
In addition, the implementation of roof-integrated PV systems for renewable power generation creates, by means of the corresponding subsidy schemes, the possibility of securing financing for the entire construction project.

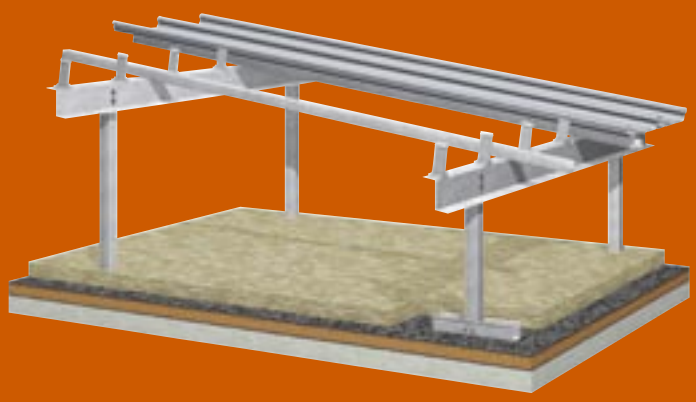
The advantages of the Kalzip® renovation concept:

- Lasting, practically maintenance-free building protection, without follow-up costs
- No interruption to operations
- High freedom of design
- No disposal costs for the existing roof sealing
- Contributes to meeting National Energy Saving Targets for CO_2 reduction
- Active environmental protection by means of optional additional components such as solar technology or Kalzip® Nature roof
- Receipt of government subsidies and favorable energy efficiency classification in energy certificates

Roof renovations with Kalzip® systems are the perfect way to increase the value of buildings, and also actively provide environmental protection – today and in the future.

Town hall in **Mastershausen (D)**
Architect: Birger Boos
Right: before renovation
Above: after renovation





Schematic diagram of the lightweight steel structure

Maximum performance with Kalzip® Solar Power Systems: concise information on system planning.

Location and orientation

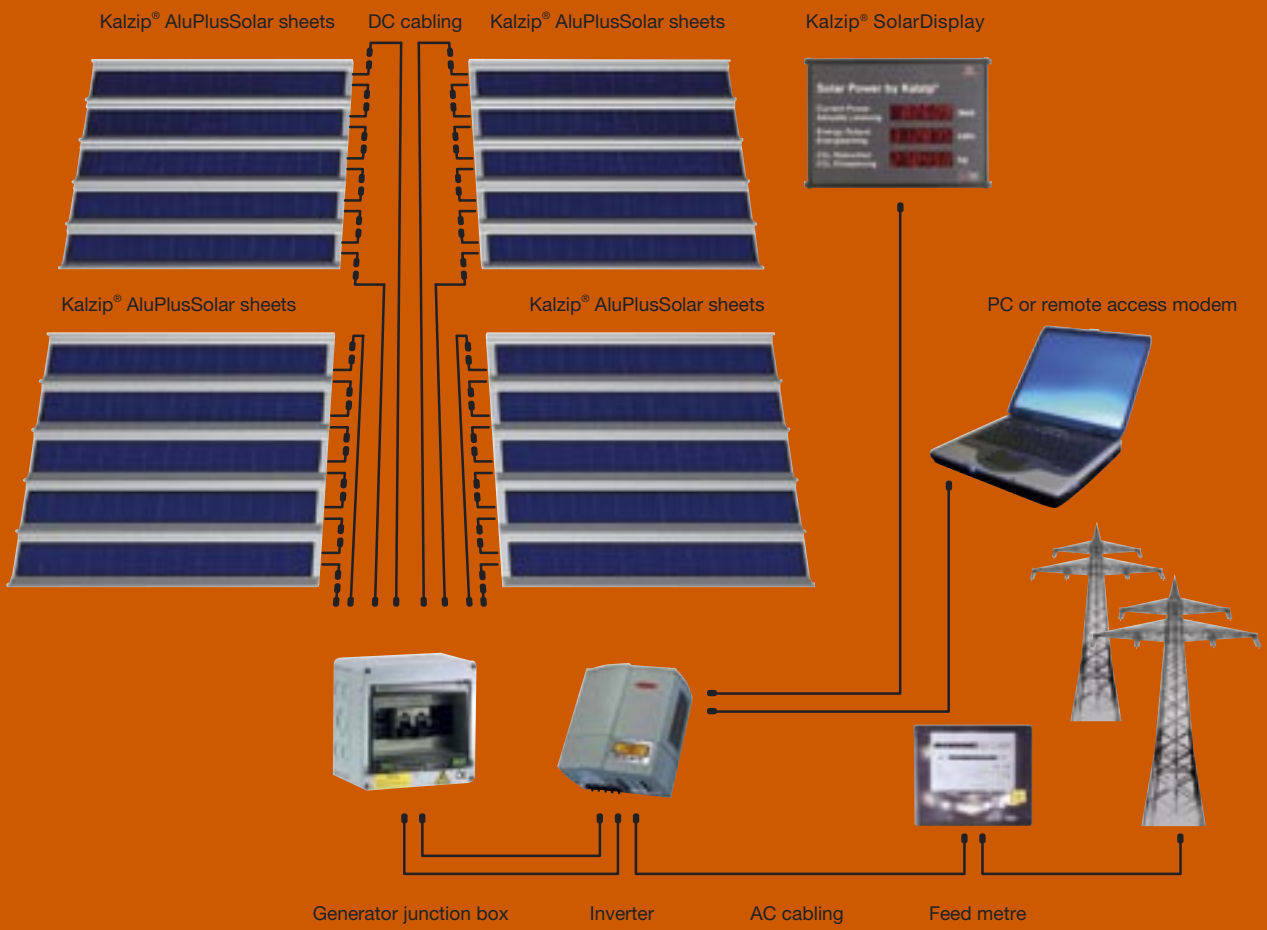
The average annual solar irradiation in Europe ranges from 1,752 kWh/m² in southern Spain to 876 kWh/m² in the North of Scotland. The average in Germany is around 1,000 kWh/m².

Solar cells

When PV laminates absorb light they produce an electrical voltage which results in the generation of a direct current. Solar cells are semiconductor materials which immediately convert light energy into electrical energy. This occurs by means of silicon layers which are designed to absorb the specific spectral colours of sunlight.

Photovoltaic systems

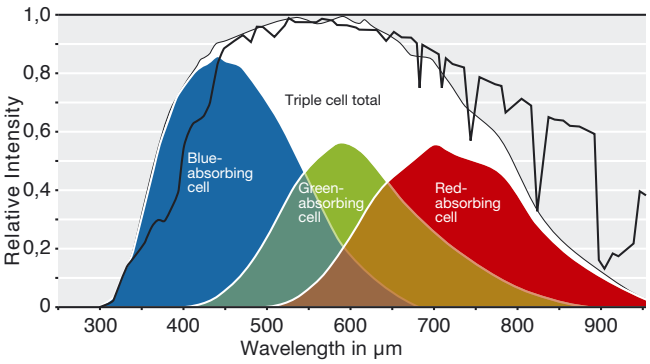
Every grid-connected PV system essentially consists of the solar laminates which generate direct current upon solar irradiation. DC cabling is routed through a central generator junction box, where fuses and lightning protection can also be integrated. The inverter then converts the direct current into a grid-compliant alternating current. The feed metre measures the amount of energy fed into the mains grid.



The advantages of amorphous thin-film technology:

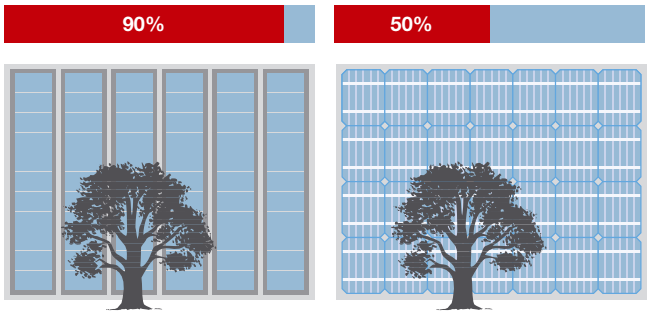
Triple-junction technology

The solar cells used in amorphous silicon thin-film laminates consist of three silicon layers applied one after the other. The different layers are optimized so that each layer can optimally convert a different range of the light spectrum to electrical energy. This enables greater efficiency in diffuse light conditions, which constitute the predominant form of daylight in central and northern Europe. The specific yields of a Kalzip® AluPlusSolar or Kalzip® SolarClad system are thus, depending on local conditions, 10-20% higher than yields from a regular crystalline system in identical conditions.



Tight bypass circuitry

When partially or temporarily shaded, amorphous thin-film laminates have at their disposal a bypass circuit so that the system power is not significantly reduced or affected. This is in contrast to a similarly shaded crystalline system which, in the event of partial shading, would deactivate much larger areas.



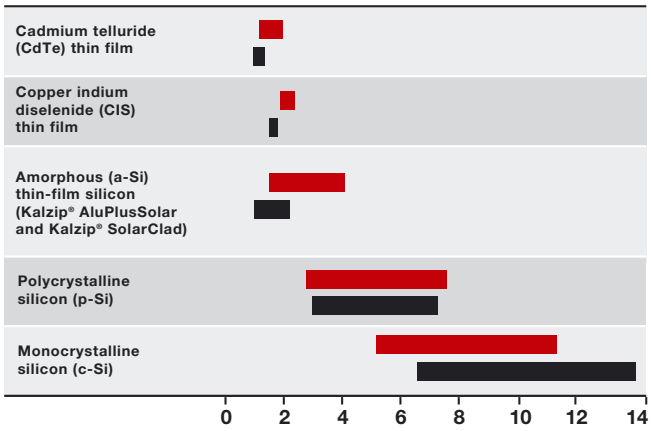
Amorphous module
(e.g. Kalzip® AluPlusSolar)

Crystalline module

Environmentally friendly

The low energy demands during the manufacture and the high yields result in an energy payback time of approximately 3 years. This is a fraction of the required energy payback times for crystalline modules.

Cumulative energy consumption and energy payback time of frameless PV modules



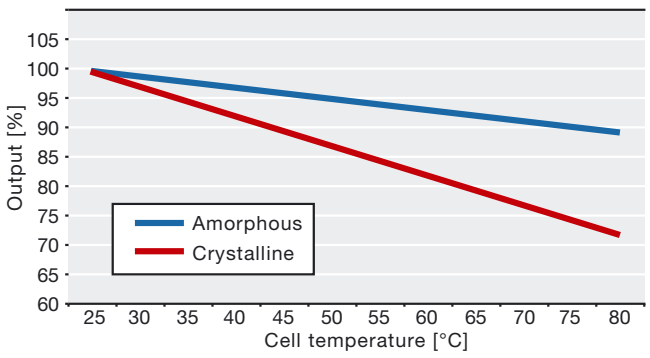
Ranges from different studies for calculation of:

Cumulative expenditure of energy (CEE) in gigajoules per m
Energy payback time (EPT) in years

(Data source: Möller, Jochen. 1998.
Integrierte Betrachtung der Umweltauswirkungen von Photovoltaik-Technologien.)

Temperature performance

The temperature coefficient describes the output reductions exhibited by solar cells when exposed to heat. For regular monocrystalline or polycrystalline modules, this coefficient is around -0.5%/K. For the PV laminates used in Kalzip® Solar Power Systems, it is only -0.2%/K.



Photovoltaic systems are a rewarding investment in the future.

In addition to the different government subsidy schemes in the EU, which make PV systems an economically profitable capital investment, environmental protection should also be mentioned. For example, in Germany approx. 40 percent of the harmful, climate-affecting carbon dioxide emissions are caused by power generation.

Every kilowatt hour of solar electricity generated and fed into the National Grid reduces CO_2 emissions. The reduction in levels of carbon dioxide emissions depends on the nature of the energy source displaced. In Germany, a 10 kWp solar system generates approx. 8000 kWh per year, which results in a saving of 5040 kg of CO_2 each year.

In addition to this environmental aspect, a further advantage of Kalzip® solar systems as standalone power generating solutions is that electricity can be produced and consumed in-situ. The energy payback time of a PV system is the time required by the system to generate the same amount of energy as is required to manufacture the product.

Thanks to improved technologies and greater efficiency, this is considered to be three and five years for photovoltaic systems. This shows that PV systems yield many times the amount of energy required to produce them over their service life (> 20 years), and are therefore highly sustainable construction products. Fossil fuel systems never reach this point; with an energy yield factor which is always negative.

Left: Aldi store in **Beilngries (D)**
Architect: Kehrbach Planwerk

Kalzip® customer service – optimal support and individual consulting.

Along with our all-in-one programs for Solar Power Systems and roof renovation, we offer you extensive service and consultancy. Our skilled technical service advisors will support you early in the planning process.

If you have questions, or would like a detailed, personal consultation please contact the sales office responsible for your area. The addresses can be found on the reverse side of this brochure.

You can obtain further information at:
www.aluplussolar.com
Here you will find valuable planning assistance, an FAQ and information area, as well as the „Kalzip® SolarDesigner“ software for project development of individual construction projects involving Kalzip® Solar Power Systems.

Subsidy schemes and payments make solar architecture interesting from an economic point of view. You can obtain an up-to-date overview on the following website:
www.solarfoerderung.de

www.kalzip.com

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