

Ernst Schweizer AG



Roof as a BIPV plant

Solrif® = large surface roof tile

- Swiss BIPV pionier with Solrif®
- 20 years experience
~ 1 GW installed in EU
- BIPV standard for the future



Why roof as a BIPV plant ?

Normal roof is only costs =>

No return on investment



Roof parallel PV =>

Focus on production



BIPV with Solrif® =>

Focus on production

and building aesthetics !



Why BIPV roof integration?

- Because it belongs to the variety of application possibilities
- Because it is obvious and makes sense
- Glass is a high quality construction material
- Saving material => better carbon footprint
- Building aesthetics in PV is getting more important it must fit optically in building and urban concept
- Knowledge about local roofs and BIPV can be competitive advantage for installers
- Because costs are valued differently => more value creation for installer



Roof as power plant - photovoltaic in-roof mounting system Solrif®



Solrif® = **Solar** roof **integration** **frame**



Solrif® = Solar roof integration frame

1. Substituting standard module frame = **module frame**

2. Substituting roof parallel mounting system = **mounting system**

3. Substituting classic roof cover = **PV roof tile**

Solrif® = 3 in 1 !

=> **material and cost savings**

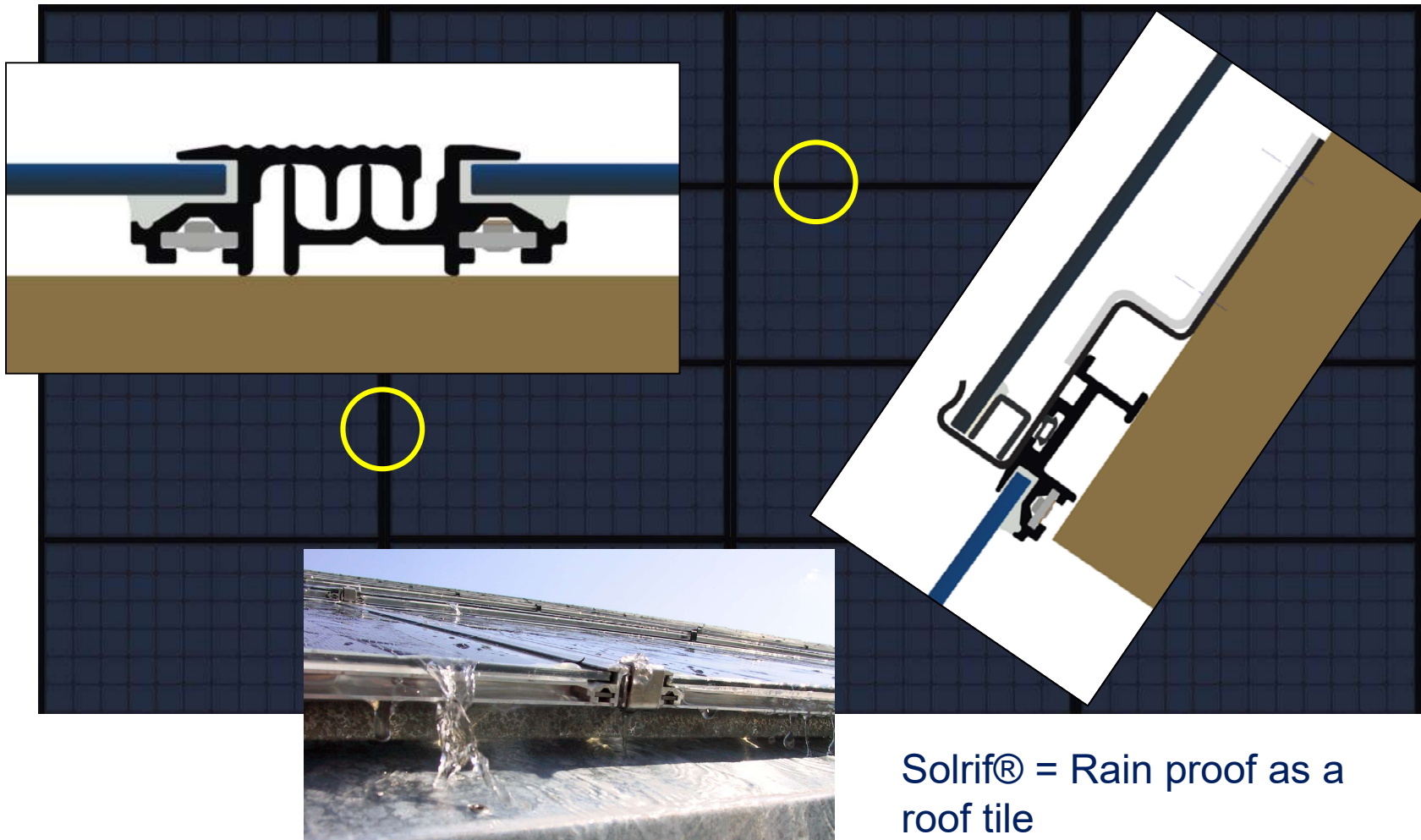
=> **easy to install**

=> **beautiful**



The Solrif® system

Interlocking and overlapping as roof tiles



Solrif® = Rain proof as a roof tile

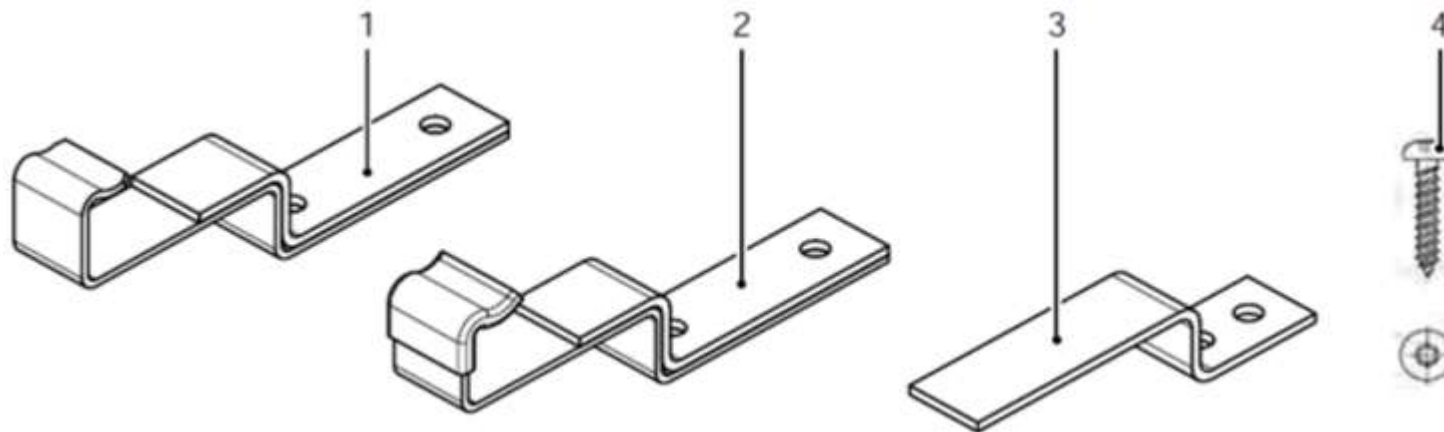
Besides Solrif® framed modules, how many other parts are needed to install complete roofs like below?



Only 2 other types of parts!



Mounting clamps Solrif®

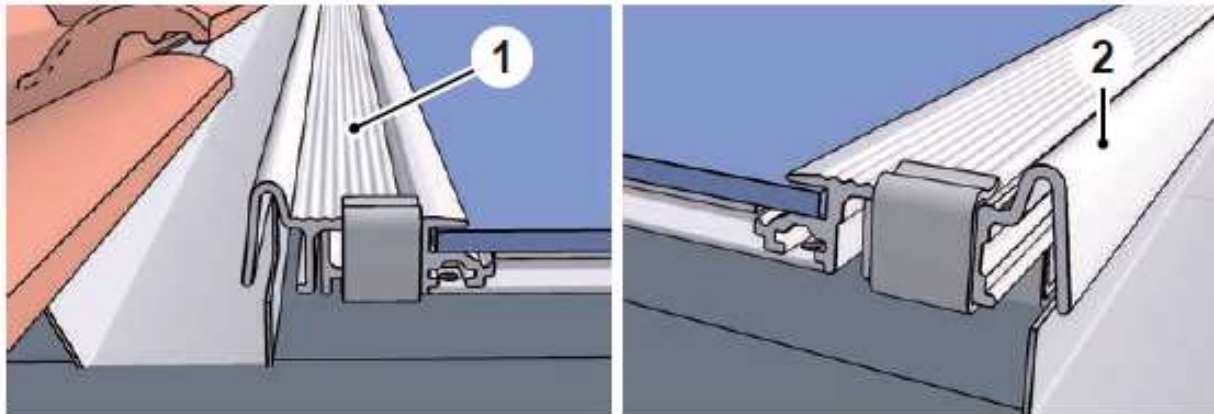
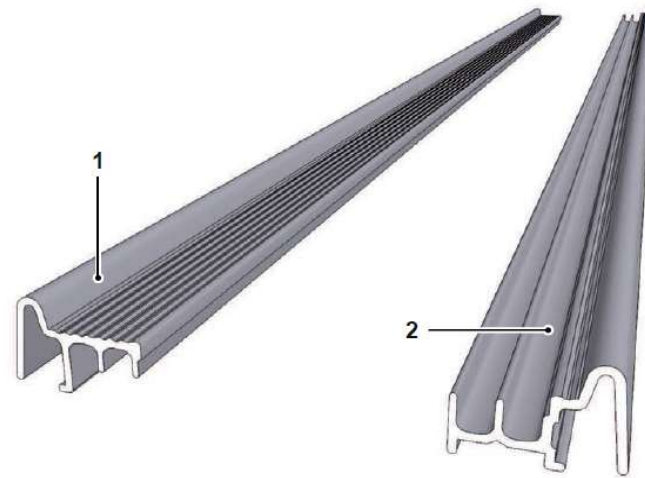


1. Mounting clamp profile
2. Mounting clamp glass
3. Mounting clamp top long for plain flashings top
4. Pan Pan Head Screw, 4.5 x 35 mm

Plus flashing profiles

1 - Flashing profile left

2 - Flashing profile right



Complete roofs can be built with the mentioned clamps and flashing profiles!



ABZ Settlement, Switzerland 2015

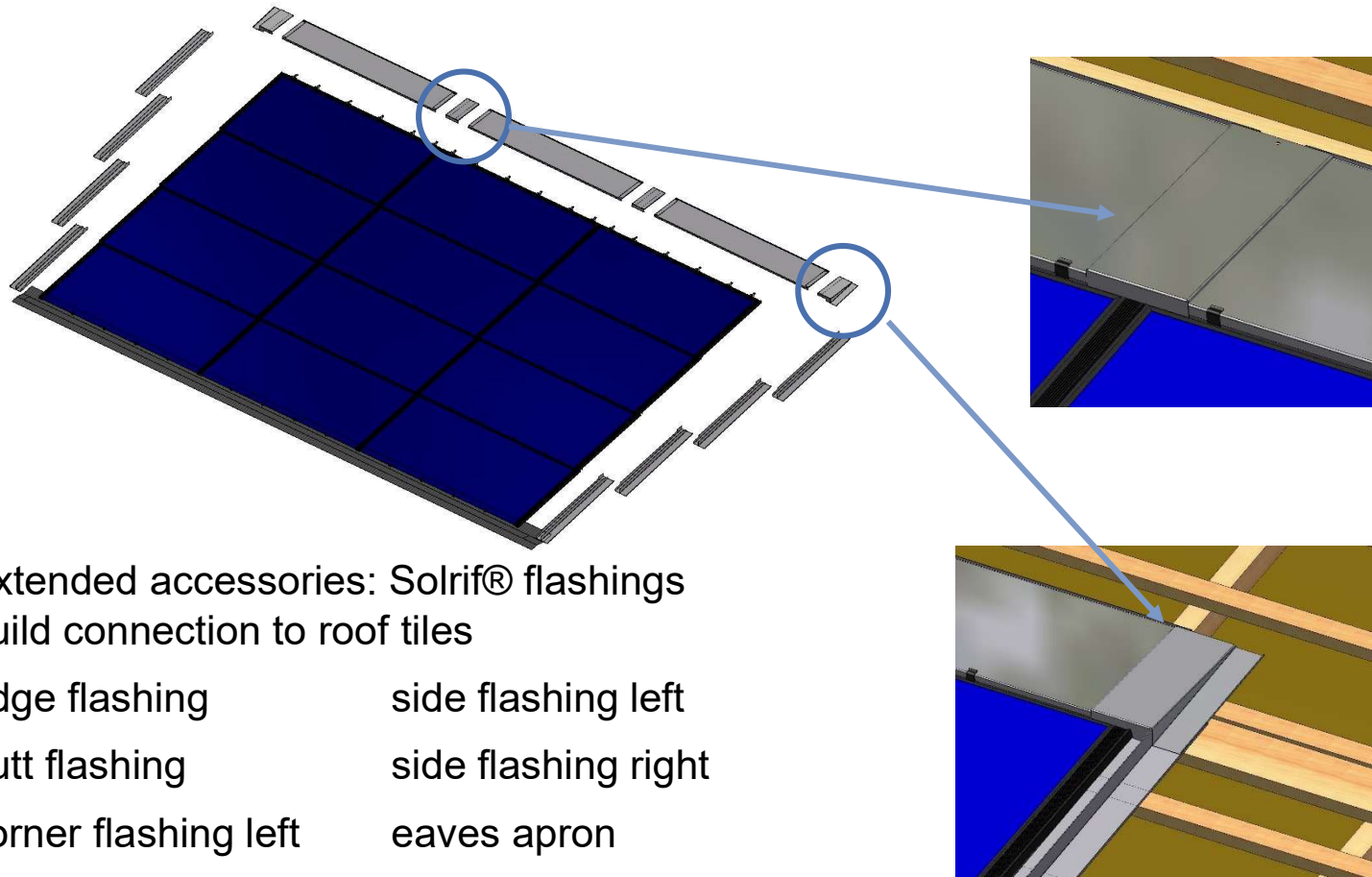


Sinlge and Multi famlily homes with Solrif



Accessories for partial roof installations

New universal flashings for 60 cells of different module suppliers



Extended accessories: Solrif® flashings
build connection to roof tiles

ridge flashing

side flashing left

butt flashing

side flashing right

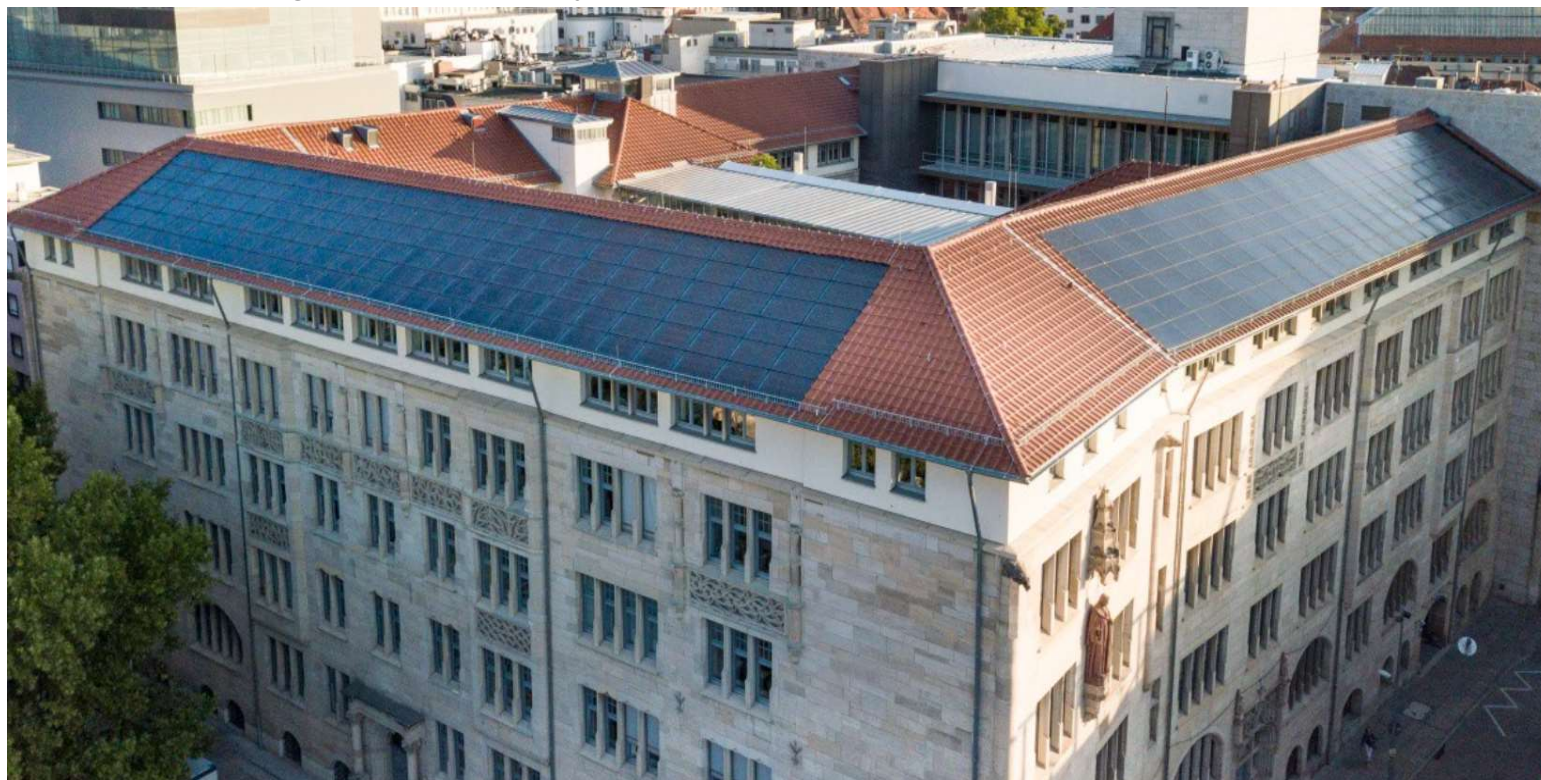
corner flashing left

eaves apron

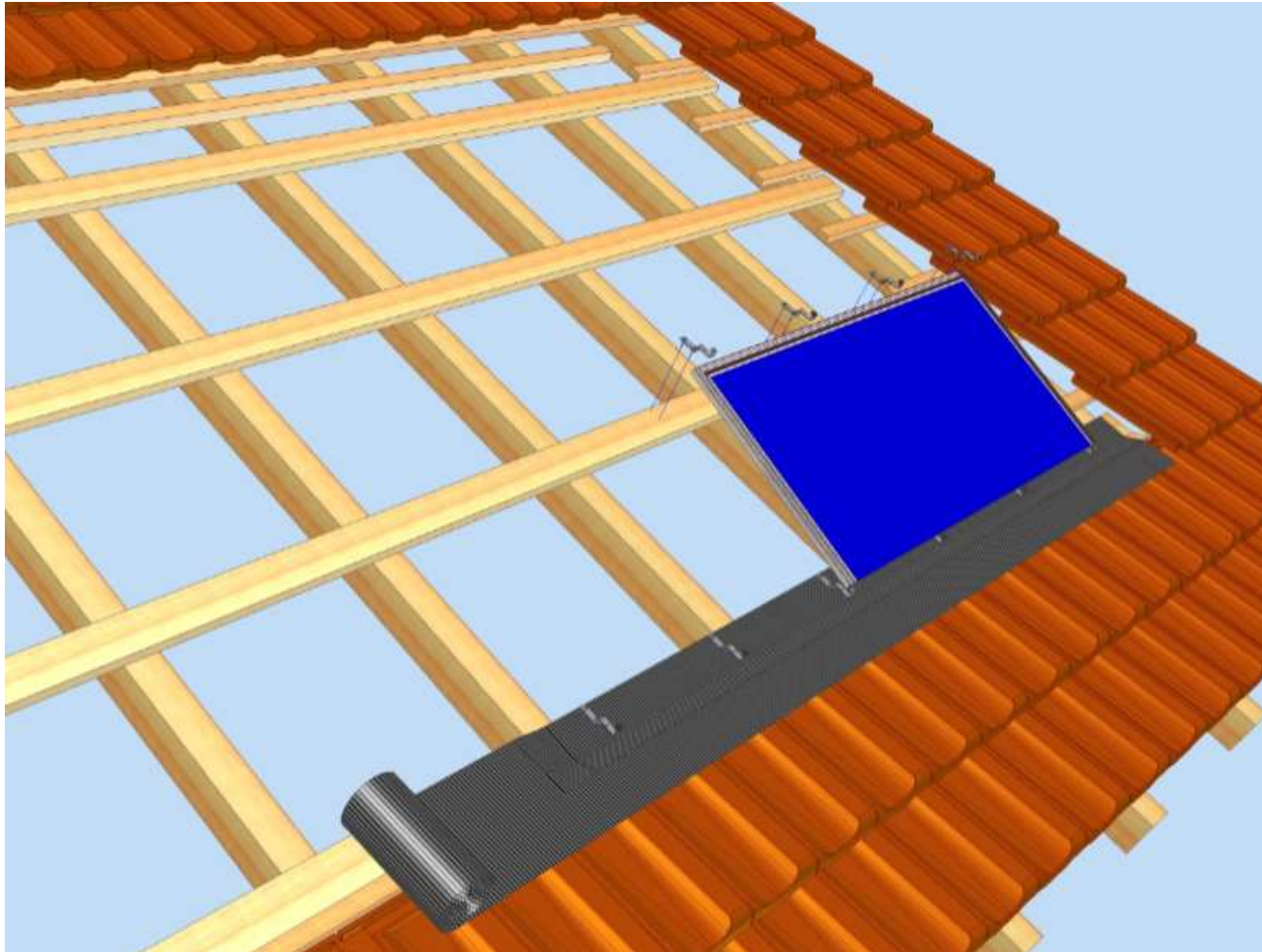
corner flashing right

Example of partial roof with Solrif® with flashings

Town hall Stuttgart in Germany 2018



Solrif® installation in combination with roof tiles



Solrif® roof preparation

Substructure as for tiled roof

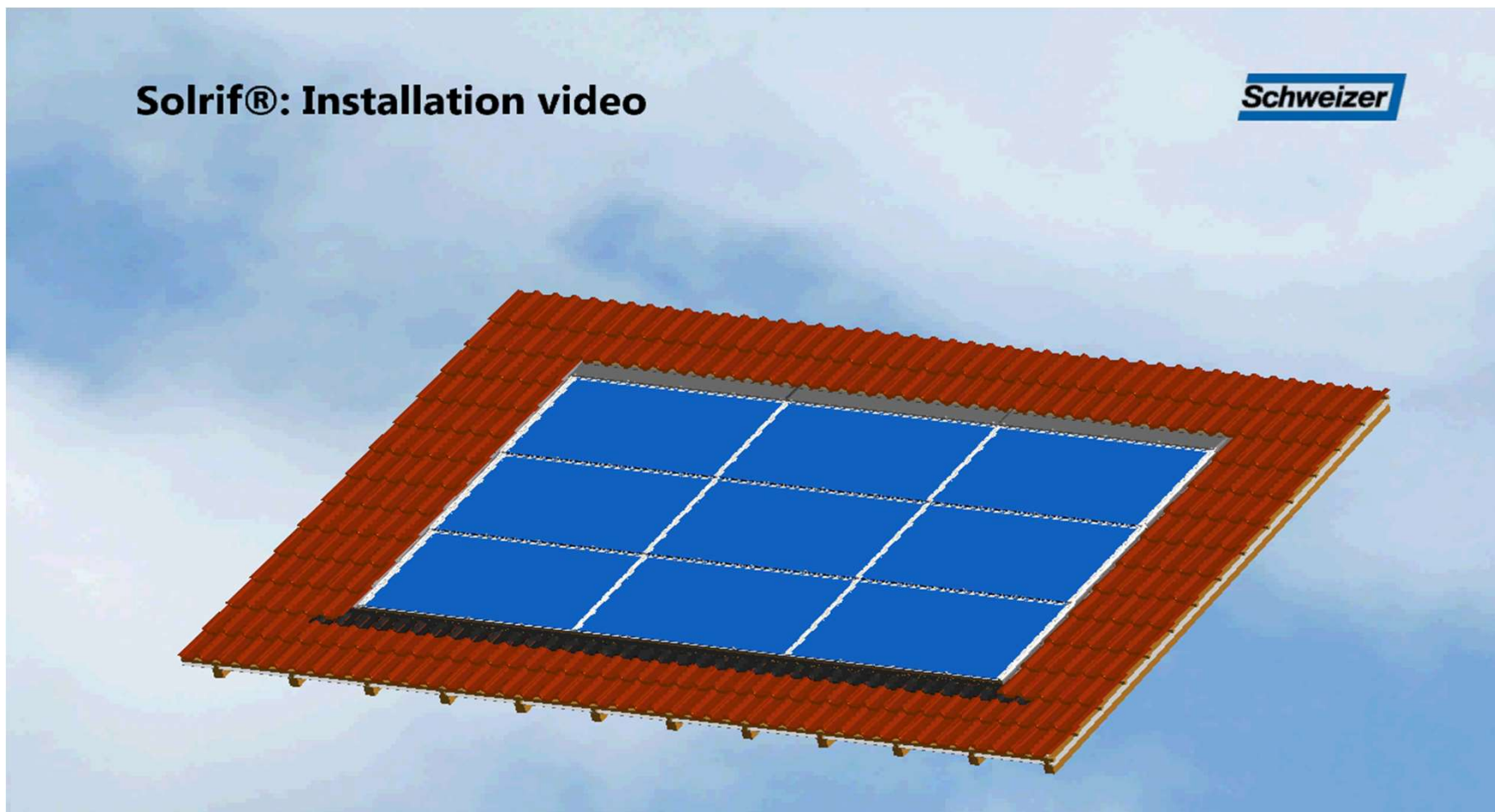
- Rafter
- Foil
- Counter batten
- Solrif batten



Transition with «triangle» plank



Basics of installation

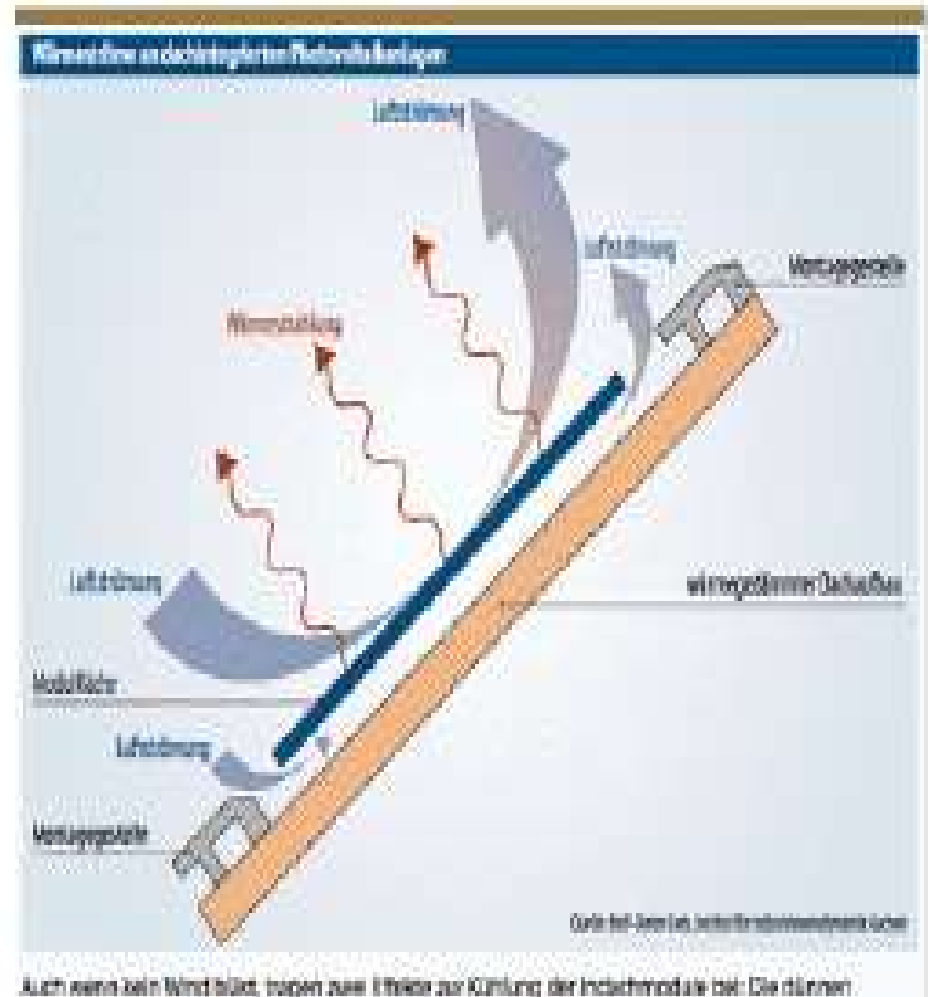


Solrif®: Yield and rear ventilation

- PV Magazine, 2015
- Heat flows at roof-integrated PV system
- Rolf-Dieter Lieb, Institute for Industrial Aerodynamics in Aachen:
 - Cooling 80% via the front
 - Only 20% via the rear side
 - Within the scope of usual dimensions insignificant differences!

Conclusion:

Roof-parallel comparable to roof-integrated



Why Solrif®?



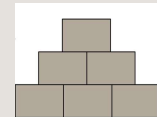
- For over 20 years approx. 1 Gigawatt installed and market proven!
- Only system that is consistently based on roofing techniques/ and roof tiles:
 - Large area roof tile (size 60 cells module)
 - Simple fastened with "storm clips"
 - Roof structure as for tiles: Roof foil, counter batten, and 12 cm wide "solrif" batten
 - Modular similar to roof tiles
 - Low weight per m²!

Why Solrif®?



Very flexible design on roof:

- Whole roof/partial roof
- Dummy modules
- Move lines e.g. hipped roof
- skylights, chimneys ...
- Special modules



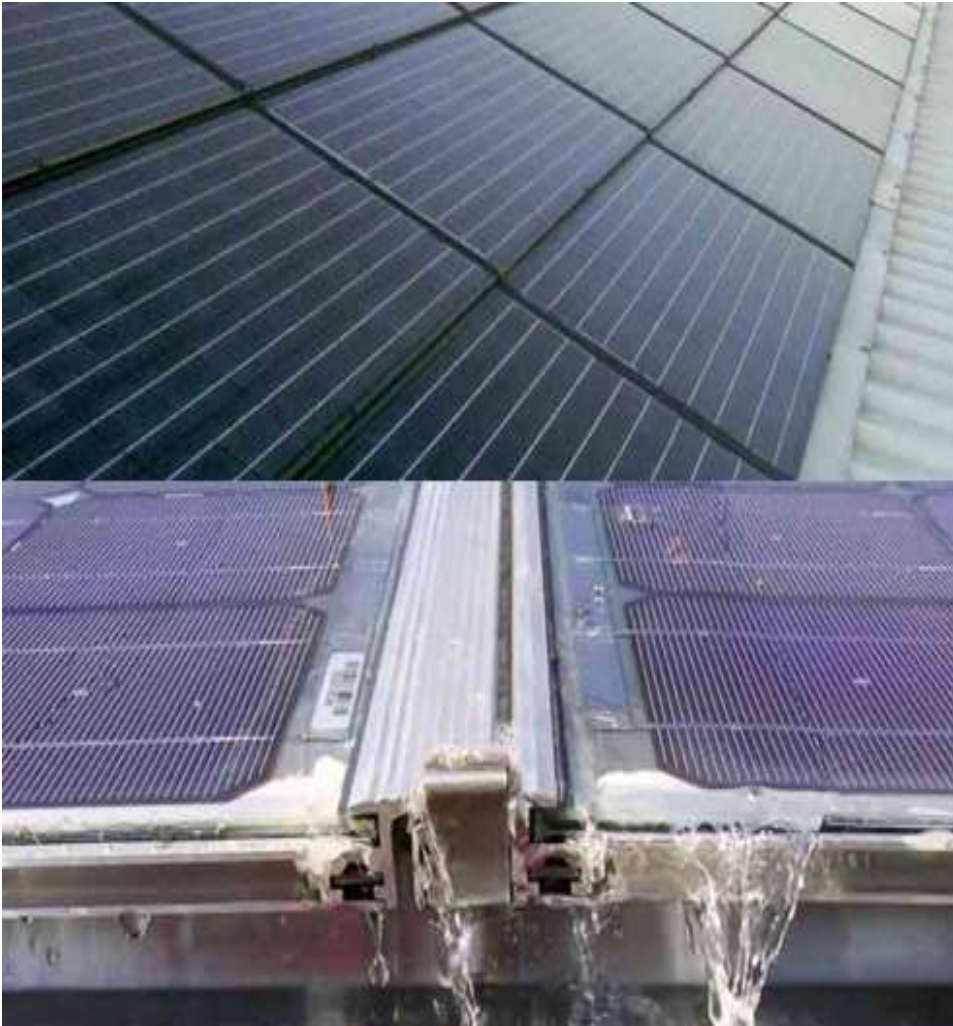
Why Solrif®?



Very flexible design:

- Different formats 60-, 48-cells.
- Any colors possible (e.g. terracotta)

Why Solrif®?



Free lower glass edge of module:

- High yield: Good self-cleaning effect and slippage of snow.
- No damage of module frame
- No glass breakage: "Insertion system" ("fixed point-sliding point" principle)
- Extremely simple and quick installation
- Modules can be removed individually
- Low frame proportion
- Tested: IEC, CSTB, MCS, prEN15601

Most important advantages of Solrif®



Reliable

- 20 years market proven (first installation 1999) > 850 MW installed (EU)
- PV- roof tile” based on high quality standard laminates
- Free glass edge (bottom): High self cleaning effect and sliding of snow → higher yield
- Technically reliable (IEC, CSTB, MCS, prEN 15601)

Flexible

- Simple and quick installation with mounting gauge (~ 10 min/m kWp)
- Individual modules can be easy removed for maintenance
- Even barrel roofs are possible

Beautiful

- Standard black looks like black slate roof
- Any RAL color and optic is possible



Economic comparison (€/m²)

Approximate advantage 25-30%!

Costs	Solrif® BIPV	Roof parallel PV
Module frame and framing	22.00 €/m ²	5.25 €/m ²
Mounting system	5.60 €/m ²	14.00 €/m ²
Flashings	7.75 €/m ²	0.00 €/m ²
Roof tiles	0 €/m ²	30.00 €/m ²
Sum	35.35 €/m²	49.25 €/m²

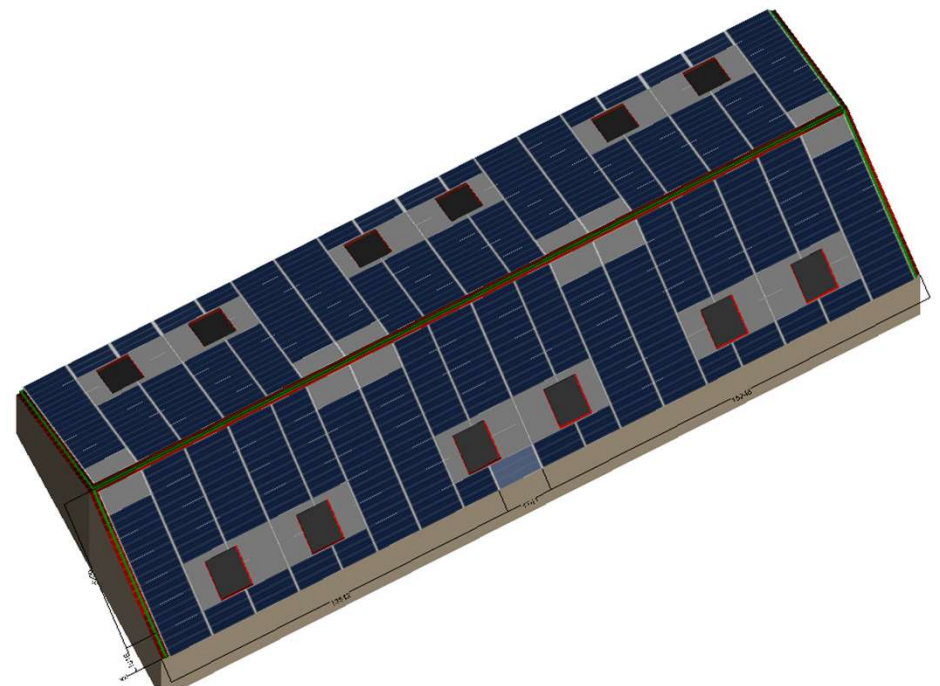
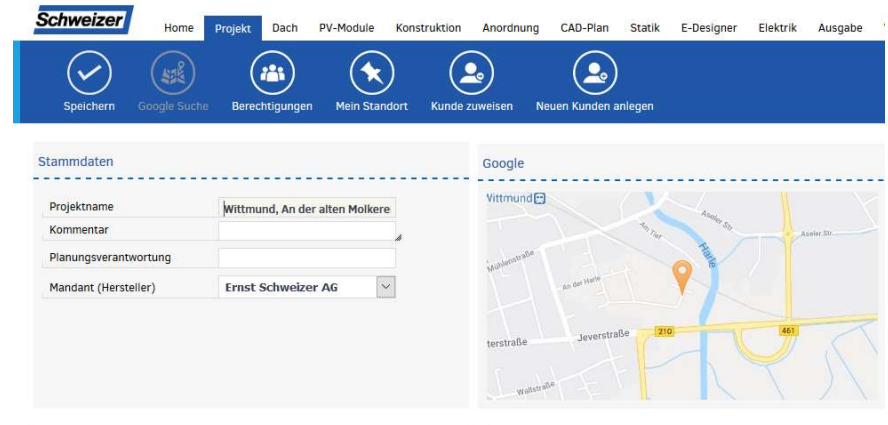
- Assumptions: Modules 300 Wp, module field 6 x 7, total output 12.6 kWp
- Consideration of costs for module frame and framing, mounting system and roof covering (area of PV system)
- Outside the cost consideration: PV module, installation costs

Schweizer PV Tool (SPT)



Innovation

- Software: solar.pro.tool with modern and new features:
- Google maps Snow, wind loads all over Europe
- Several module types can be combined
- Blind modules, roof windows, snow catchers
- Multiple buildings or roofs
- Detailed report with structural analysis
- <https://ernstschweizer.solarprotool.com/Account/Logonernstschweizer>



How Solrif® started 1999 to 2021 subsequent reference projects

First Solrif® installation in 1999, it produces still perfekt after 21 years!

Multi family building, Zürich, Wollishofen, 100 kW



Design details from early installations



Swiss Solar Award 2001

Complete roof retro fit - Single family house, Erni,
Untersiggenthal, 12 kW



France, typical 3 kW installation

Special tariff for integrated solutions (also Spain and Italy)



New buildings 2006 Vauban Freiburg i. Br., Germany

Already plus energy buildings realized with Solrif®

More information on <https://siedlungen.eu/>



Churches full black modules

Partial roof historical church in France



Complete roof modern church Switzerland



Multi family home Switzerland, 2013



Solrif®, agricultural building in protected context 2013



95 kW Meggenhorn (LU), Switzerland

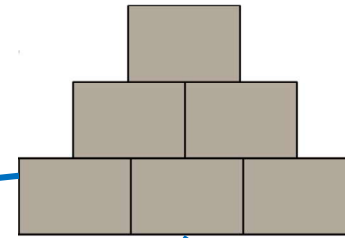


Flexible system

Retrofit complete roofs with shifted modules

Non rectangular shapes and dummy modules

Modules can be mounted shifted



Flexible system

Even barrel shaped roofs are possible

Production site, Italy



Library, Spain



Mountain cottage Kessiboden in Swiss Alps at 1725 m

With special measures
construction in high snow load
areas is possible



Special adaption on farm building

Stockfarm Germany: Air extraction for hay drying



Complete roof new construction

With special shaped Solrif® modules Germany, 2018



Two complete roof examples

From experienced installer Penthon in Sweden

Mölndal, outside Gothenburg, 2018

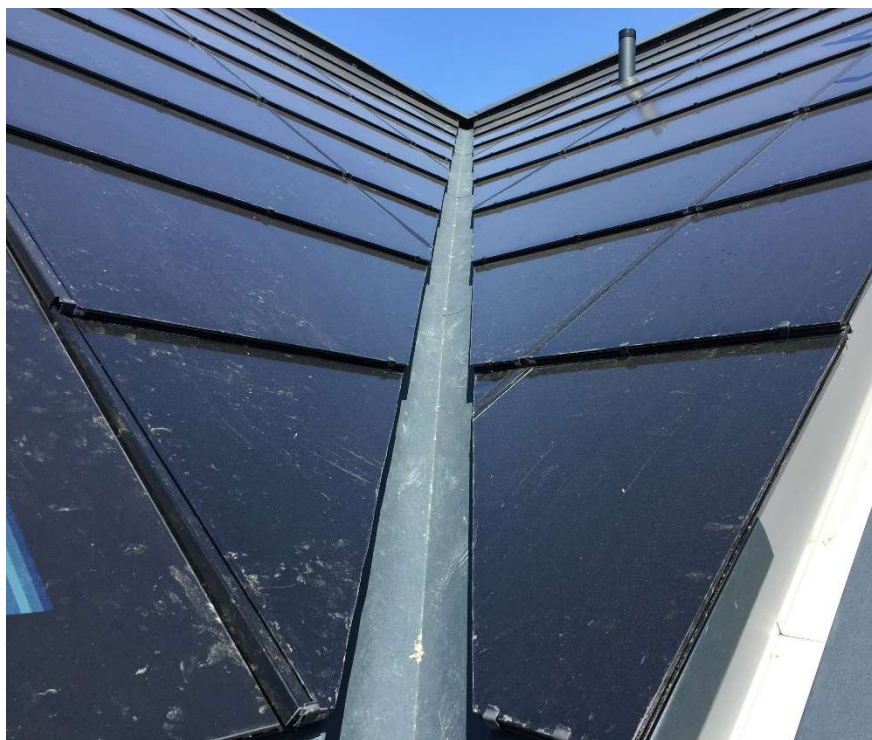


Boathouse in Malmö, 2019



Dummy modules

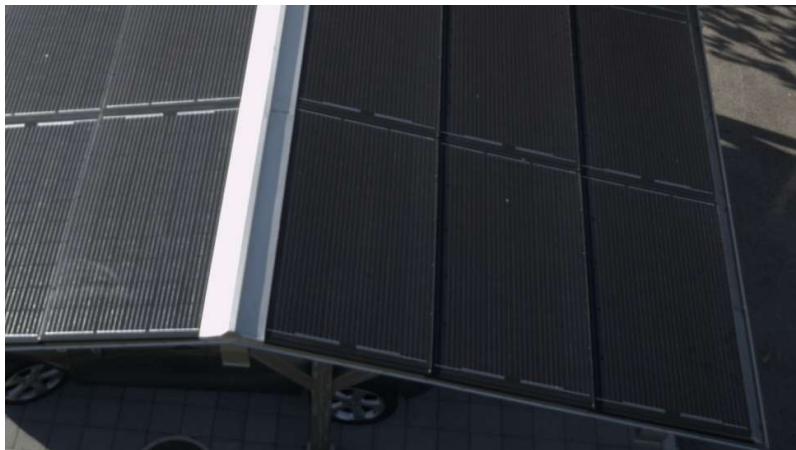
Roof valley



Hipped roof



Carports with Solrif



Multi Family House

Appartmenthouse CKW Switzerland 2020



Biggest Solrif® installation ever, industrial roof 2.7 MW

Florim, floor and wall tile manufacturer, Italy 2020



Future BIPV?

More attractive due to more color options?

Swiss cantonal emblems as BIPV facade modules



Solrif® terracotta, realized in UNESCO world heritage area, lake Geneva, Switzerland



Future PV? – All surface PV and all buildings off grid?



Example multi family home Switzerland: First 100% energy independent building in the World. No grid connection!

Built 2016: 1010 m² living space, 6 flats between 80 and 145 m²



Future PV - BIPV ? - More holistic concepts?

Example: Wood and straw plus BIPV + social aspects in planning

Straw bale settlement with BIPV, Nänikon Switzerland 2019

Manufacturing Energy:

- Straw 1 m³ = 10 – 15 kW
- Rock wool 1 m³ = 300 – 700 kW

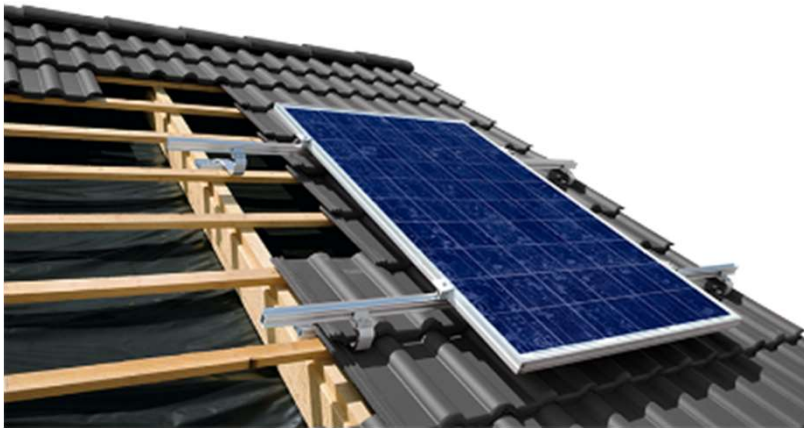


Ernst Schweizer AG Further PV product Lines



MSP-PR for pitched roofs

Click-in system makes install easy and fast



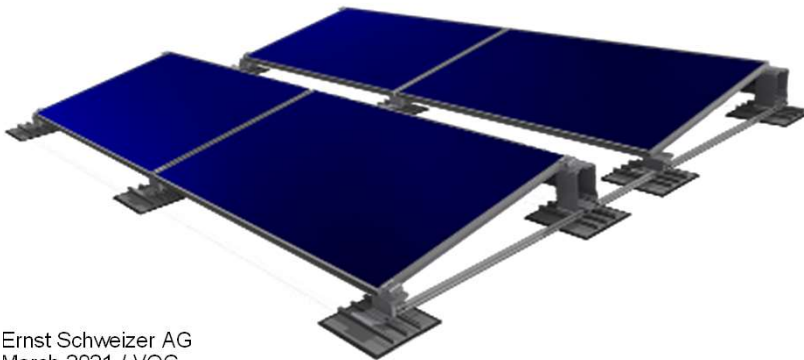
MSP-TT for trapezoidal metal roofs.

Only 2 components for fast, cost effective installation



MSP-FR-S mounting system for flat roof (South)

Combinable with MSP-FR-EW (East-West)



MSP-FR-EW mounting system for flat roof (East-West)

Optimized for minimal ballast and installation costs



Ernst Schweizer AG

Thank you for your interest and attention!

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