



PPV – Parking lot Photovoltaics



## Company Profile

schlaich bergemann partner are independent consulting engineers.

Since the founding of our office in 1980 by Jörg Schlaich and Rudolf Bergemann, our aim has been to design and develop innovative structures. Our projects range from long-span lightweight roofs, a wide range of bridge types, slender towers and innovative buildings, to pioneering solar power plants.

For more than three decades, schlaich bergemann partner has been consulting and developing technologies in the renewable energy sector. Due to outstanding success, sbp sonne gmbh was spun off in 2009 to house all the office's renewable energy activities, and became subsidiary of schlaich bergemann partner in early 2021.

Today, sbp sonne is arguably the most experienced solar engineering office globally, leading specialized and cutting-edge technology development projects in six continents.



Alf Oschatz  
Managing Director



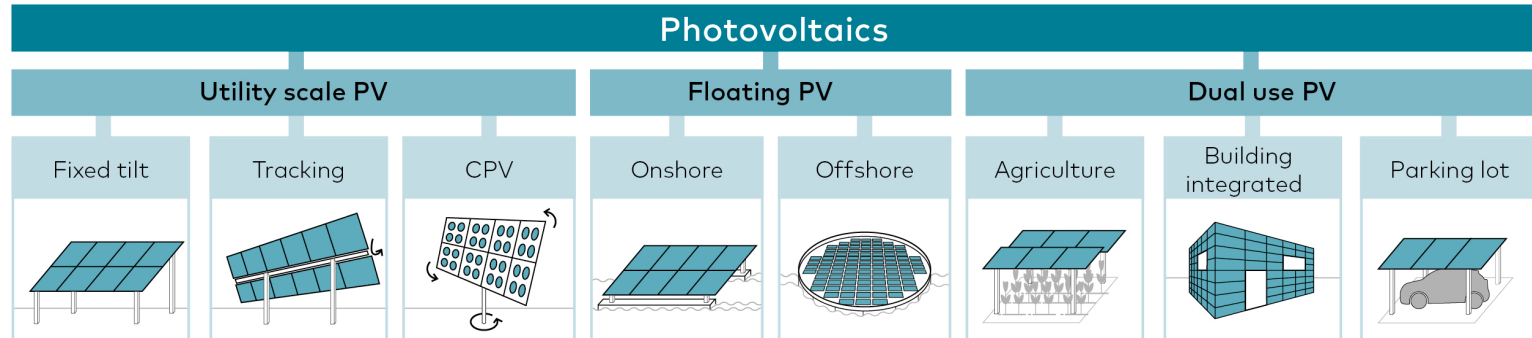
Gerhard Weinrebe  
Director

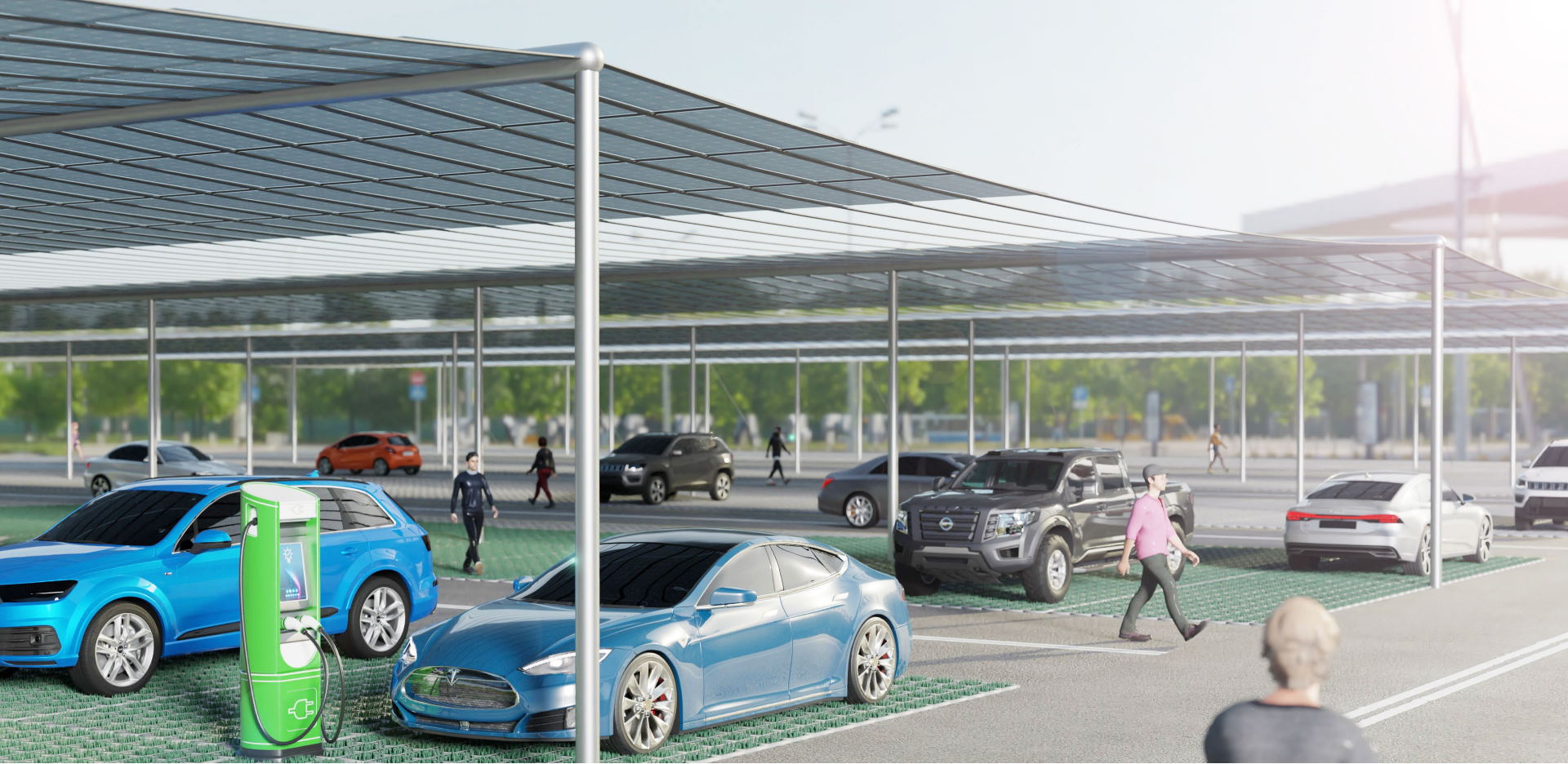
## Scope of Work of sbp sonne gmbh

Solar power will play the most important role for future energy supply. For this reason, sbp sonne is dedicated to developing new technologies for the use of solar radiation – ranging from large utility scale power plants to decentralized power production.

Our key technologies include:

- Single axis photovoltaic trackers
- Fixed-tilt photovoltaic structures
- Floating photovoltaic systems (FPV)
- Agricultural photovoltaic systems (APV)
- Parking lot photovoltaic systems (PPV)
- Building integrated photovoltaic systems (BIPV)
- Concentrating photovoltaic systems (CPV)
- Parabolic trough collectors
- Heliostats and technologies related to solar power towers
- Climate covers
- Dish Stirling systems
- Solar updraft towers





## What are the ecological & economic benefits of the sbp PPV solution?

### Ecology is a must

- Significant reduction of your carbon footprint
- Large independence from external energy supplies
- Climate-neutral operation of your company
- Significant contribution to resource conservation and CO<sub>2</sub> savings
- Helps to get aligned with China's current 5-year plan
- Highly efficient use of materials and short energy payback time

### We increase the income of your parking lots

- Increase the financial return of parking lots
- Create a further source of stable income
- Shield your customers from rain, frozen windows and hail or heat in summer
- Make your parking lot the architectonic highlight of your company

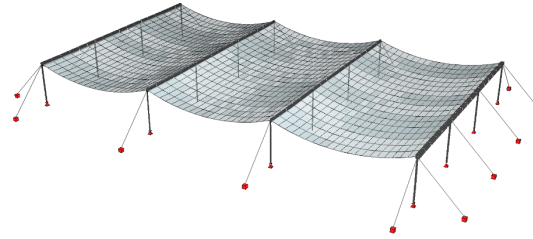


## State-of-the-art: Steel solution



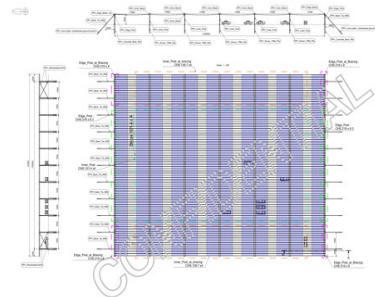
- Inefficient steel construction solution through separate structural systems (separated row by row) or wide cantilever constructions.
- Large and costly foundation required
- High structural costs
- Poor life cycle assessment due to high resource consumption

## Optimized Structural Solution



- Efficient structural system (tension system) to reduce steel tonnage
- Light weight cable supported system (core expertise of sbp for 50 years)
- Construction for fast installation further reduce costs
- Small and flexible pile foundation, easy refurbishing of existing parking spaces
- Resource saving and utilization of building materials
- Perfect suitable and most efficient for large parking lots
- Design according to GB code (e.g.: wind loads, induced oscillation)
- Easy accessibility for maintenance
- Integration of lighting design or other electric requirements possible





### Execution example: PPV Volkspark Stadium, Germany (ongoing)

- |   |                       |
|---|-----------------------|
| • Parking lot area  | 17,000 m <sup>2</sup> |
| • PV area (~75%)  | 12,480 m <sup>2</sup> |
| • Installed capacity  | 2,500 kWp             |
| • Net annual energy yield (over 25 years / typical German solar location)   | 2,300 MWh/a           |
| • Annual saved CO <sub>2</sub> emissions (versus typical German energy mix) | approx. 1,000 tons    |



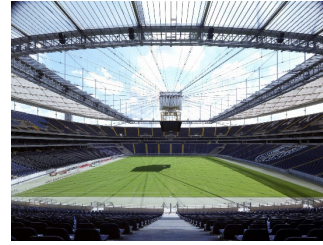
Roof for Munich Olympic Stadium – Munich, Germany



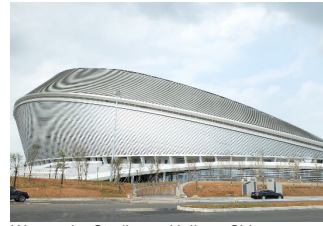
Heart of Doha – Doha, Qatar



Ting Kau Bridge – Hong Kong, China



Deutsche Bank Park – Frankfurt, Germany



Wuyuanhe Stadium – Haikou, China



Panoramic Tower Killesberg – Stuttgart, Ger

## Lightweight cable supported roofs → core expertise of sbp for 50 years

- Started with roof of Munich Olympic Stadium 1972
- All engineering aspects covered:
  - Pretension
  - Anchoring
  - Installation
  - Cable specifications
  - Wind loads
  - Vibration and damping
  - Durability and lifetime
  - Code design

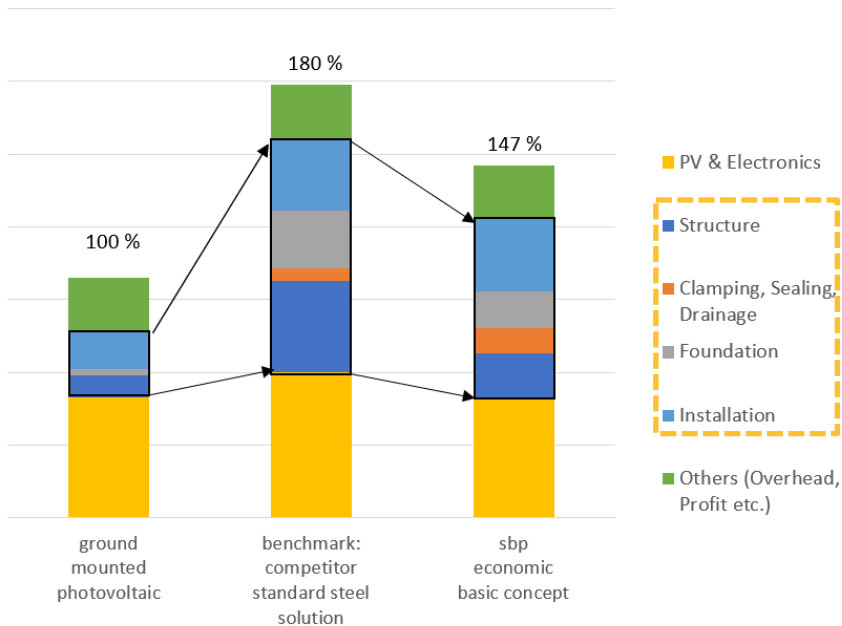


Guangzhou South Railway Station – Guangzhou, China



Moses Mabhida Stadium – Durban, South Africa





## Specific cost comparison sbp concept vs “benchmark” competitor



Cost for PV modules is highly optimized  
almost identic for all competitors



Structural elements, foundation and installation  
account for more than 50% of the total investment cost

### Conclusion:

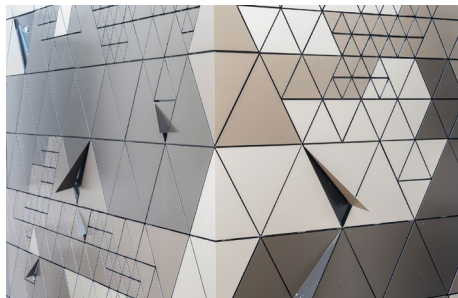
With the current PPV cost structures cost potential all  
lies in innovative structural solutions



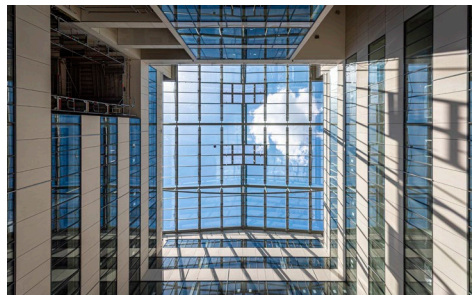
Steel and lightweight constructions



Industrial buildings and facades



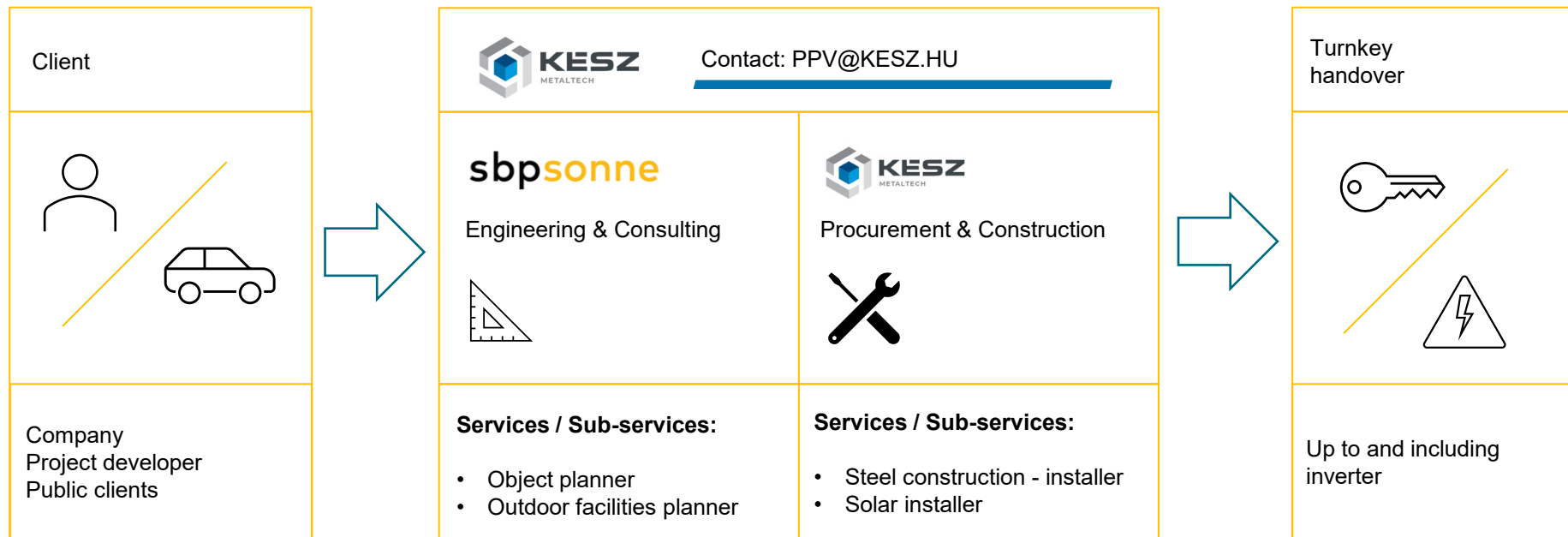
Facades in building construction



Glass facades

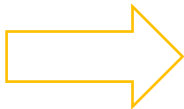
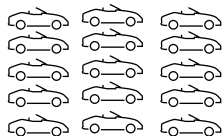


**KÉSZ Metaltech:** Steel constructions/ façades/ glass structures - [www.metaltech.kesz.hu](http://www.metaltech.kesz.hu)



# sbp & KÉSZ - Parking lot Photovoltaik

## Target market:



with medium  
to large parking spaces  
> 100 parking spaces

Industry & commerce  
Public clients

## Timeline:





## Project | Location | Completion

## Scope of our Work

## Client

Ideematec PV-Tracker (2200 MW), Saudi Arabia, 2020

Review of the structural system of Ideematec 2P PV Tracker

Ideematec

TubeSolar, Germany, 2020

Design of a light weight structural system for Agri PV application.

TubeSolar

PVHardware Tracker für CHINT (48.5 MW), Serpa, Portugal, 2020

Review of the structural system of PV Hardware 1P PV tracker

PV Hardware

Ibri NEXTracker (600 MW), Ibri, Oman, 2019

Review of the structural system of NEXTracker 1P PV tracker

NEXTracker

Talayuela Soltec Tracker (300 MW), Talayuela, Spain, 2019

Review of the structural system of Soltec 2P PV tracker

Soltec

Floating PV, Belgium, 2019

Design of a floating PV system

K2 Systems

Sudair GameChange Tracker (2200 MW), Sudair, Saudi Arabia, 2019

Review of the structural system of GameChange 1P PV tracker

GameChange

Talayuela Ideematec Tracker (300 MW), Talayuela, Spain, 2019

Review of the structural system of Ideematec 2P PV tracker

Ideematec

Ideematec Tracker Galloping, Germany, 2019

Review of the aeroelastic wind tunnel test results provided by Wacker engineers

Ideematec

Cabrera Soltec Tracker (200 MW), Cabrera, Spain, 2019

Review of the structural system of Soltec 2P PV tracker

Solar Century

Mahindra Tracker, India, 2018

Review of the structural system of Mahindra 1P PV tracker

Mahindra Susten

Benban PVH Tracker (160 MW), Benban, Egypt, 2018

Review of the structural system of PV Hardware 3L PV tracker

ACWA Power

## Project | Location | Completion

## Scope of our Work

## Client

Floating PV, Boskoop, Netherlands, 2018

Conceptual and detail design support and development of floating PV for lakes and Ponds

K2 Systems

Mafrag Tracker (50 MW), Mafrag, Jordan, 2018

Consulting ACWA Power to rebuild the Mafrag PV tracker solar field

ACWA Power

Development of a CPV Dish, 2015

Analysis of collector piping problems and development of solution

Solar Systems Pty. Ltd.

K2 Rack optimisation, Europe, 2014

Optimization of a PV Rack system designed by K2

K2 Systems

CPV System 1, Pune, India, 2012

Design of a tracker system for concentrated PV

Azur Space

CPV development project with Indian partner, India, 2012

Structural and optical detailed design of collector

Confidential

Photovoltaic System on the Brasilia National Stadium, Brazil, 2012

Development of design possibilities for photovoltaic modules and a collection system for rainwater

KfW - Kreditanstalt für Wiederaufbau

Photovoltaic Systems on the Roof of the Corinthians Stadium in Sao Paulo, Brazil, 2012

Basic design of the glazing roof part of the Corinthians stadium with integrated PV cells

Odebrecht

Photovoltaic Systems on the Maracana Stadium, Brazil, 2012

Development of design possibilities for photovoltaic modules on the stadium roof

KfW - Kreditanstalt für Wiederaufbau

PV Tracker, England, 2009

Conceptual design development

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