



**THE MODERN SOLAR SIMULATOR**

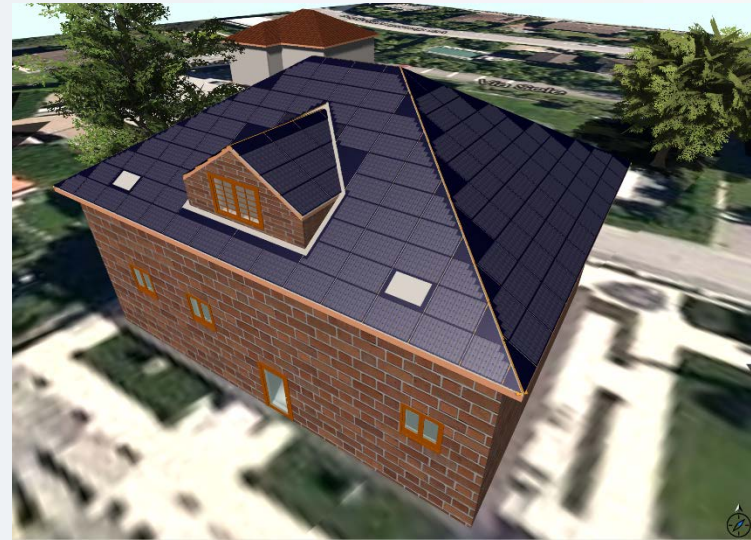


# The Company – inSun SA

A new company with an innovative approach



- ❑ Founded in late 2013
- ❑ Based in Lugano, Switzerland
- ❑ Partnership with SUPSI – ongoing research project on PV plant optimization



# The Tool - inSun

## A modern approach to PV design and simulations

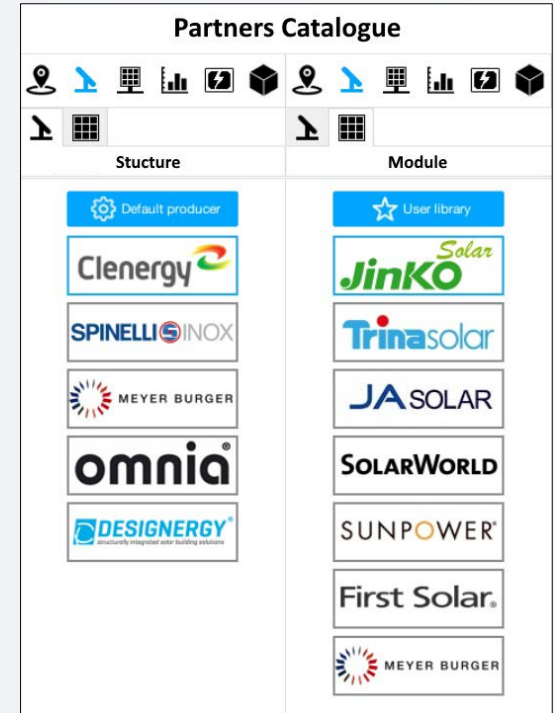
- ❑ 3D design tool based on a powerful engine
- ❑ Full lifecycle of project offering from PV design, technical drawings, bill of material and energy yield
- ❑ Integrated by geographical and weather databases
- ❑ Considers every mechanical, electrical and structural constraints
- ❑ Reproduces easily the built environment with stunning renderings
- ❑ Based on Microsoft Cloud, safe, robust and updated



# The Tool - inSun

## Product oriented

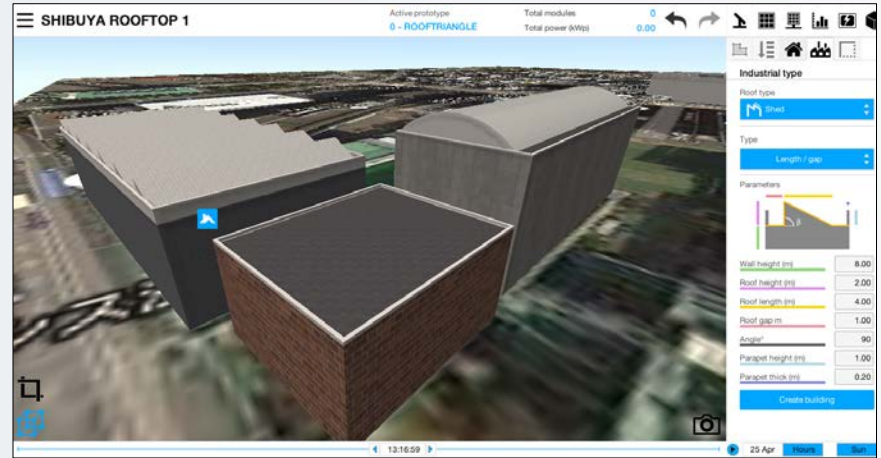
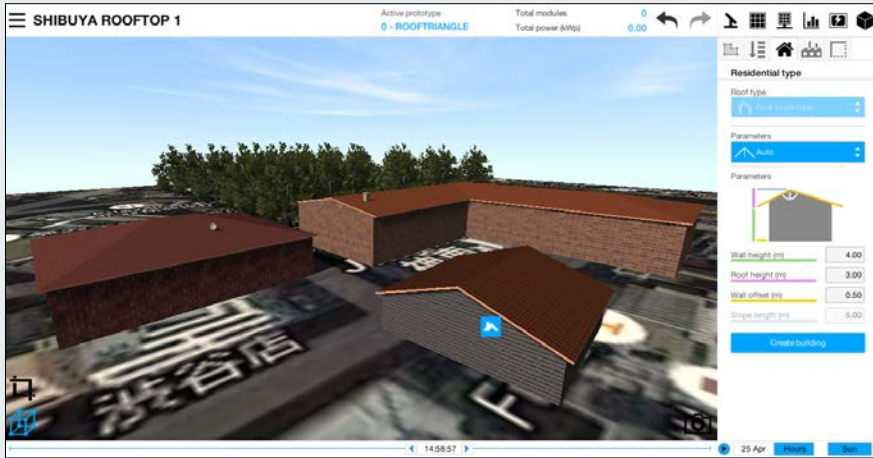
- ❑ Integrate every MLPE aspect of modules, bypass diodes, power optimizers, Maxim and micro inverters
- ❑ Integrates commercial products empowering their own technical and commercial aspects
- ❑ Takes advantage of Artificial Intelligence algorithms for simulation and optimization of PV plants
- ❑ Provides marketing data and business intelligence for manufacturers



# The Tool - inSun

## Building design

The tool allows to easily design any kind of residential and industrial building



# The Tool - inSun

## Ground mounted PV – Utility scale

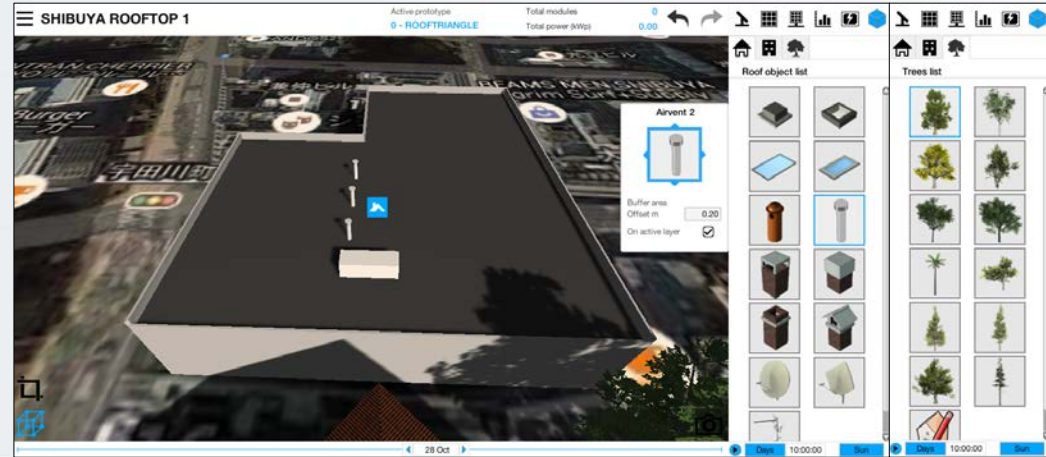
- ❑ Definition of large PV plants
- ❑ Automatic fitting of available areas
- ❑ 3D Terrain
- ❑ *Positioning of inverters*



# The Tool - inSun

## Accurate design of every obstacle

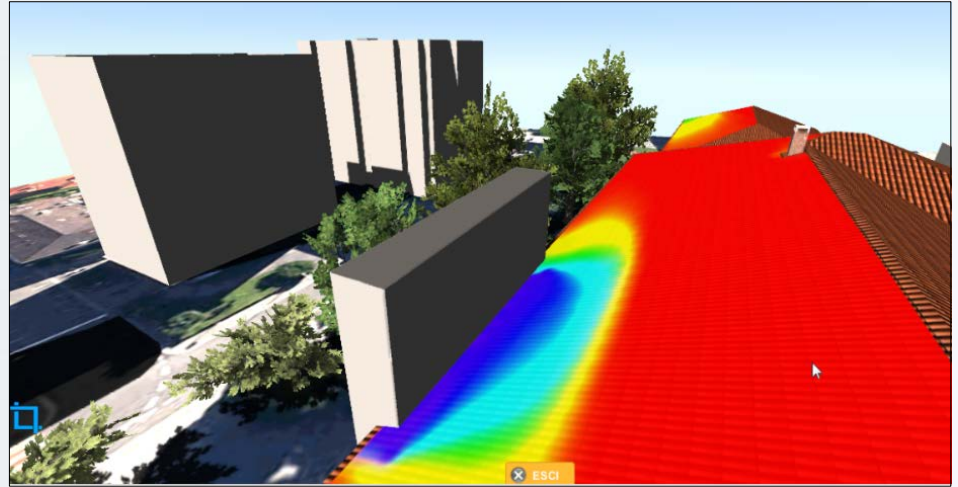
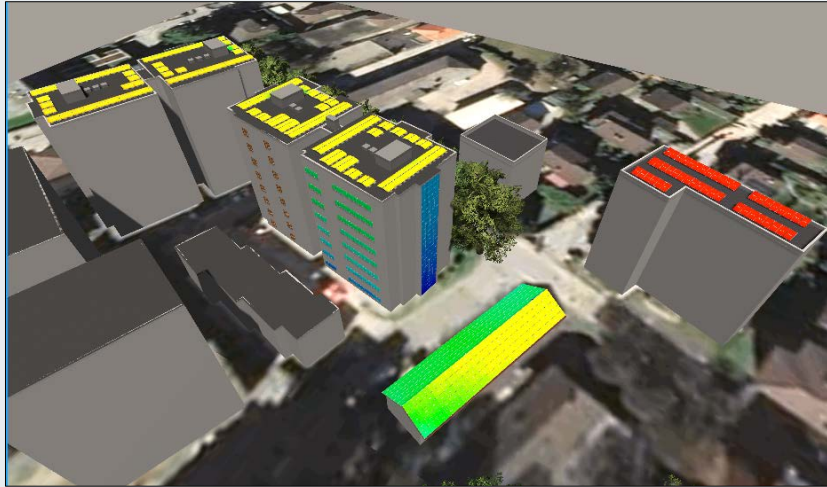
The user can design several obstacles, affecting the shading patterns, such as chimneys, trees and obstructions.



# The Tool - inSun

## Shading analysis on surfaces

Integrates commercial products empowering their own technical and commercial aspects



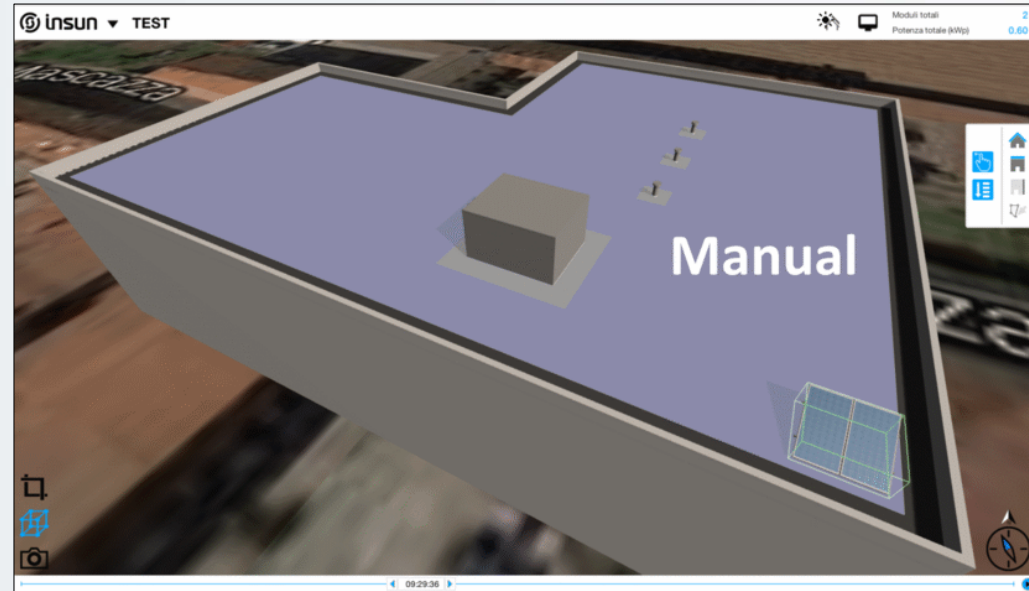


# The Tool - inSun

## Placement of PV modules

The designer can place PV modules manually or automatically following rooftop geometries, obstacles and irradiation patterns.

The positioning considers constraints of racking systems and optimize the occupation of the surface.

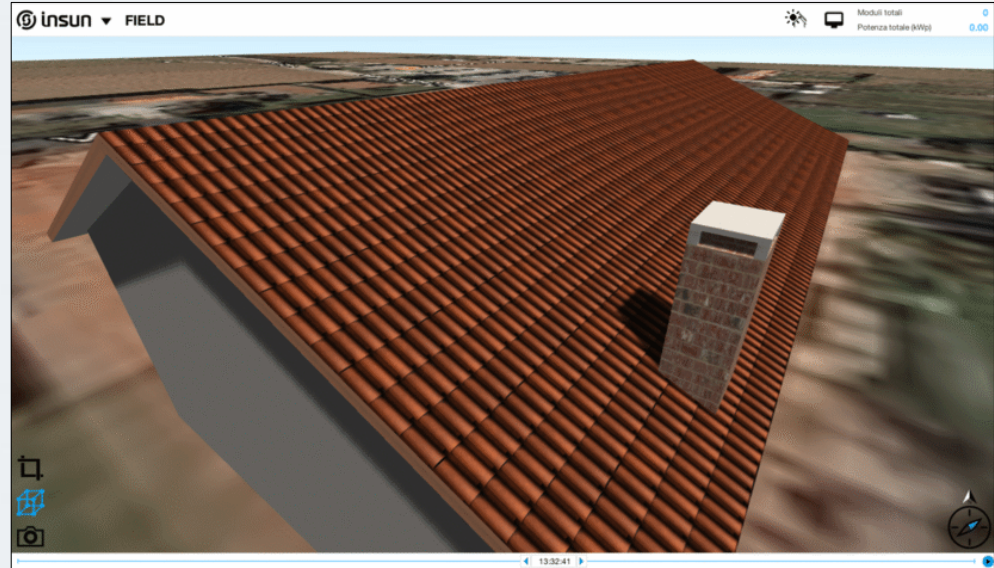


# The Tool - inSun

## Shading analysis on PV modules

The analysis of irradiation patterns on PV modules and energy yield consider the shadings on each PV cell, includes how cells are connected and every MLPE.

Comparison of different configurations is now simple and very accurate.



# The Tool - inSun

## Electrical design

Complete electrical design, strings and MPPTs definition following every inverter constraints

Active prototype  
0 - ROOFTRIANGLE

Total modules 327  
Total power (kWp) 85.03

ABB

50/60 Hz | 1-3 Phases

Select Mppt num: ALL

Available on market:

Micro | String | Central

TRIO-27.6-TL-OUTD-S2F-400

Select active fields

Merge fields if similar

SLOPE 6

Define fields

Close | Calculate

Inverters list

- TRIO-20.0-TL-OUTD-S2-400
- PRO-33.0-TL-OUTD-400
- TRIO-20.0-TL-OUTD-S2F-400
- TRIO-20.0-TL-OUTD-S2X-400
- TRIO-27.6-TL-OUTD-S2-400
- TRIO-27.6-TL-OUTD-S2F-400
- TRIO-27.6-TL-OUTD-S2X-400
- PRO-33.0-TL-OUTD-S-400
- PRO-33.0-TL-OUTD-SX-400

INVERTER MODE

String configuration

Inverter config 2

Rename configuration

Inverter config 2

Remove configuration

To Manual | Reset

SLOPE 6

Inverter number

Select starting point

Preferred distribution

Assign and Visualize

Skip assignment

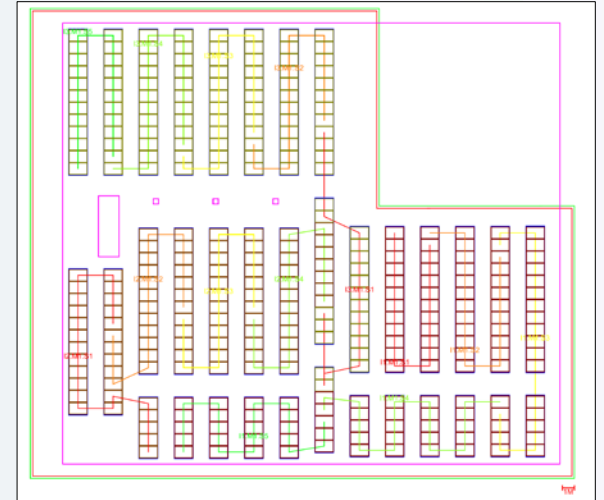
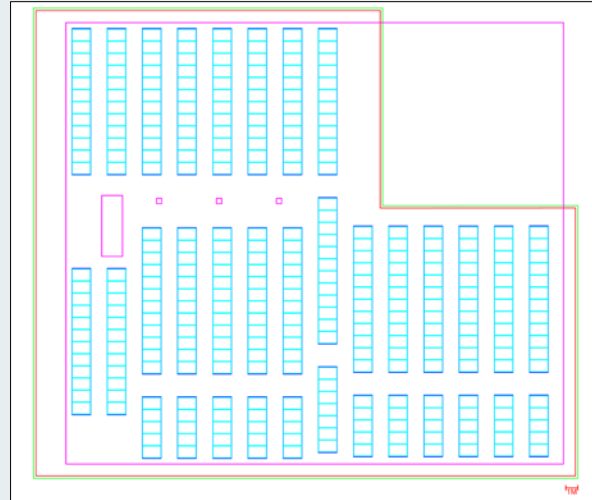
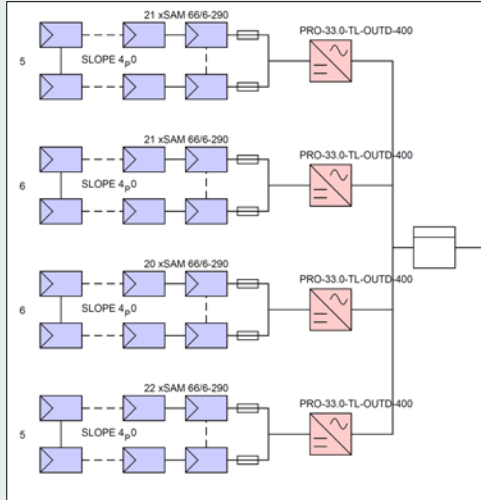
Save configuration

07 Feb | Days 10:00:00

# The Tool - inSun

## Technical drawings

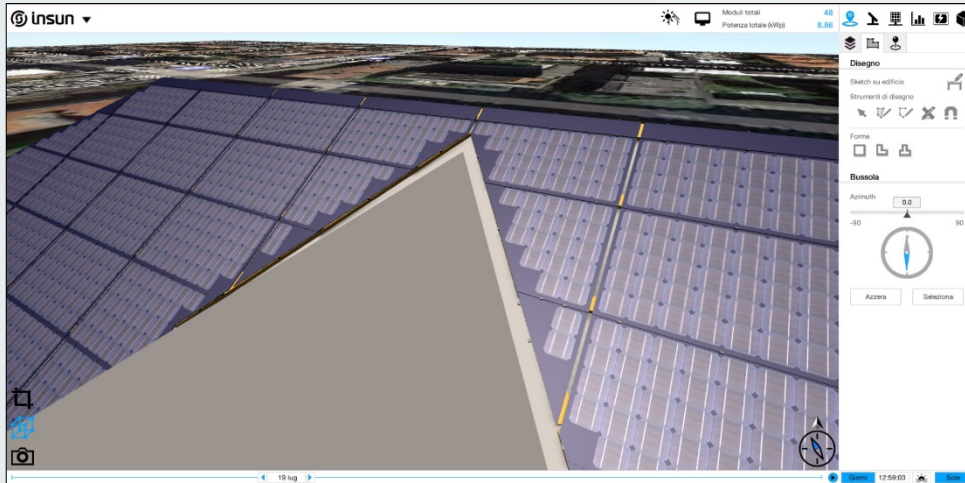
Single line diagram, electrical schemes and CAD of module placement and cables



# The Tool - inSun

## Bill of Material

Automatic Bill of Material, with regional prices connected to manufacturer's CRM



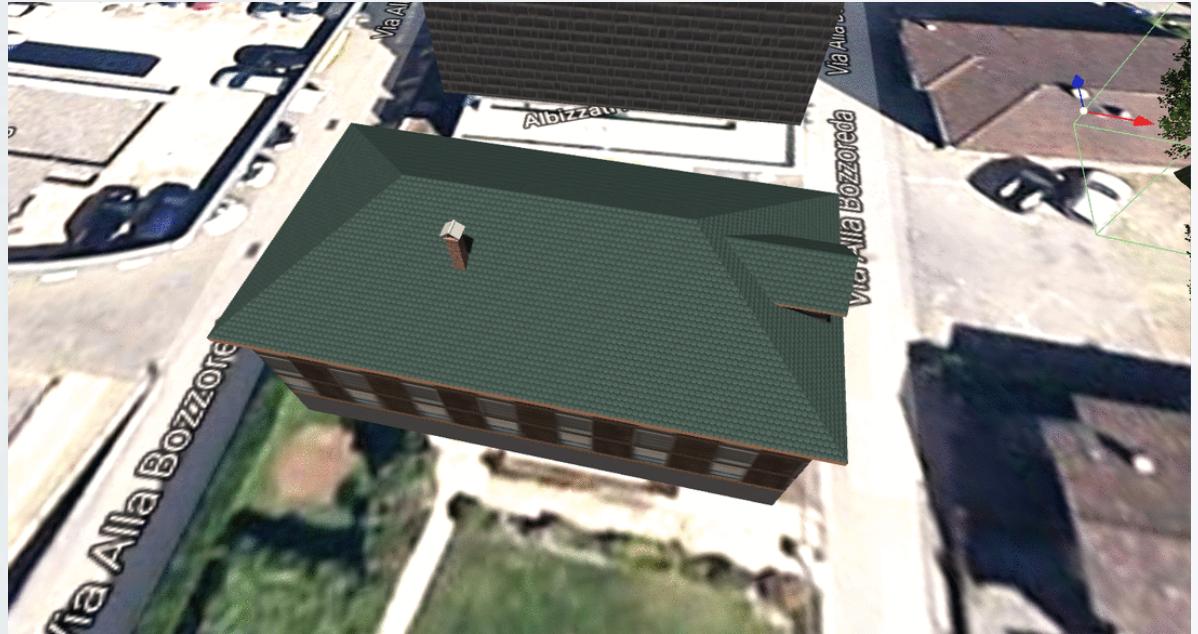
Bill of materials

Code	Description	dimensions	Price	UM	Quantity	Total CHF
500124	Wasserablauffrinne pro Modul L,M		18.90	unit	44	831.60
10093093	MegaSlate® II Haken		5.50	unit	316	1,736.00
500141	MegaSlate® II L OZ	875x1300	100.00	unit	42	4,200.00
10246819	Schraube zur Dachplatte		140.00	unit	144	20,160.00
10245011	MegaSlate L 190	875x1300	259.00	unit	42	10,878.00
10242225	Halbrundkopf SPAX®		32.00	unit	748	23,936.00
307811	MegaSlate® II Abstandhalter		2.00	unit	48	96.00
Y900017	MegaSlate® II Crea MZ		750.00	m2	14.76	11,066.80
Y900015	MegaSlate® II Crea OZ		290.00	m2	11.22	3,252.69
502835	MegaSlate® II Q OZ	720x1300	96.00	unit	4	384.00
502597	Wasserablauffrinne pro Modul Q,S		30.50	unit	4	122.00
10245016	MegaSlate Q 150	720x1300	265.00	unit	4	1,060.00
10244392	MegaSlate® II M OZ	875x985	98.00	unit	2	196.00
10245014	MegaSlate M 140	875x985	226.00	unit	2	452.00

# Test case - Residential

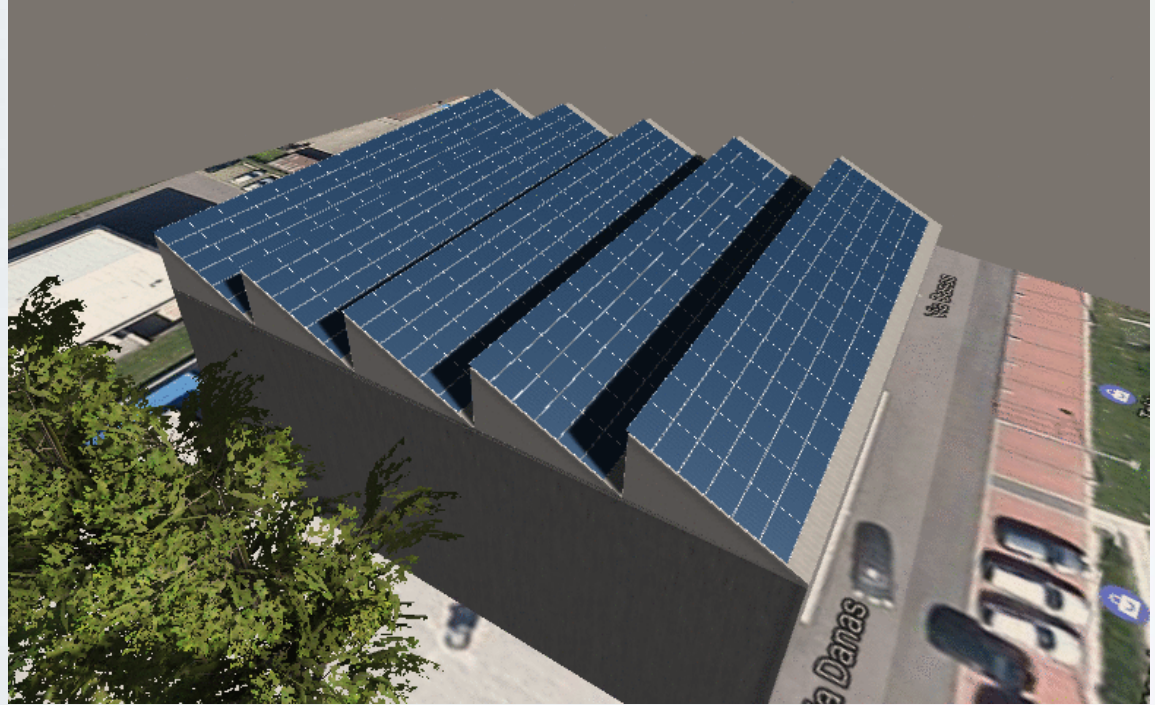
House fully covered with BIPV modules and complex shadings due to obstacles and surrounding buildings.

The optimal economic (LCOE) solution is not trivial.



# Test cases - Industrial

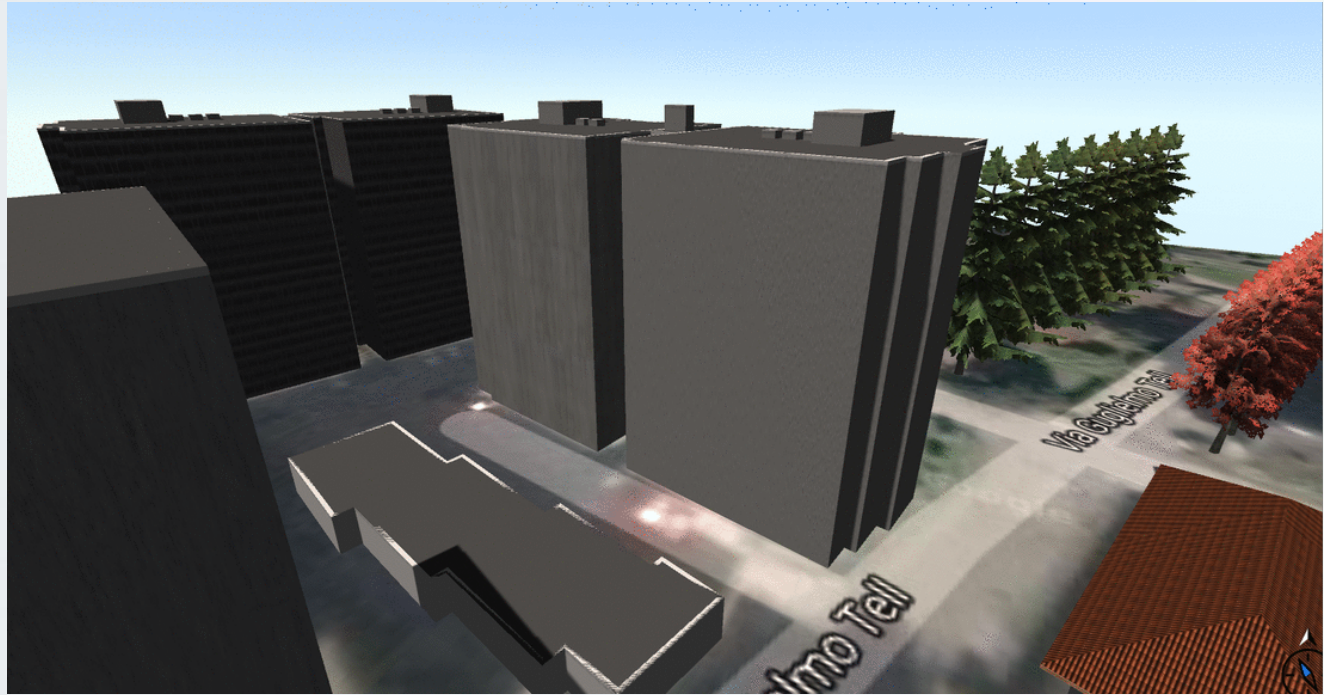
Industrial building with sheds and trees, a good positioning of modules and cabling into string and MPPTs can improve significantly overall performances.  
It could be hard to find the best trade off between cablings and energy yield.



# Test case - BIPV

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Installation on façade need to have a smart cabling of modules, very hard to design it manually depending on obstacles.





# The Tool - inSun

## Automatic detailed reporting on energy yield and economics



### Performance analysis

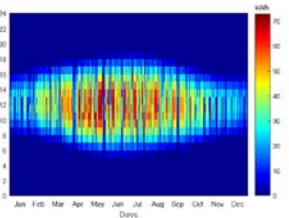
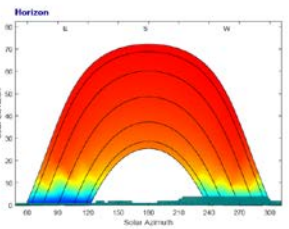
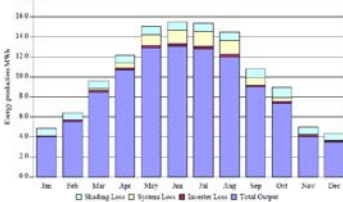
DC nominal power: 68.66 kWp AC nominal power: 71.00 kWp  
 Assumed global horizontal irradiation: 1477.09 kWh/m<sup>2</sup> Assumed global electricity/tonne: 1477.09 kWh/tonne  
 Assumed energy production: 130.02 kWh Performance Ratio: 100.02 kWh Performance Ratio PTC: 86.28%

### Main simulation data

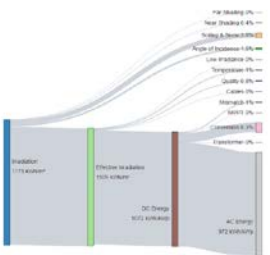
Month	Ts	SHOA	SHmax	SHmin	SHPTC	EGH4	EGH8
January	-0.11	4.81	4.95	4.02	4.02	3.95	3.95
February	0.24	6.26	5.82	3.94	3.94	5.21	5.21
March	2.52	7.93	8.52	5.24	5.24	6.44	6.44
April	10.01	11.14	11.18	10.83	10.83	10.65	10.65
May	18.11	11.04	14.18	11.13	11.13	12.86	12.86
June	21.15	11.40	14.66	11.31	11.31	13.84	13.84
July	23.83	11.58	14.11	11.68	11.68	13.79	13.79
August	21.40	14.47	11.42	11.27	11.27	12.88	12.88
September	10.40	10.78	9.81	9.45	9.45	8.49	8.49
October	1.80	8.93	7.81	7.54	7.54	7.47	7.47
November	8.61	3.81	4.25	4.12	4.12	4.81	4.81
December	1.89	4.11	3.59	3.56	3.56	3.45	3.45
Assumed YPR	11.52	122.31	112.54	105.17	105.17	802.83	802.83

EGH4: Global flat plane production EGH8: Global flat plane production with shading losses  
 EGHPTC: Global flat plane production with losses

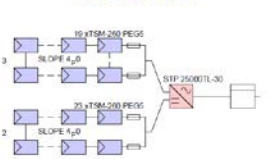
EGH4: Global flat plane energy Ts: Average temperature



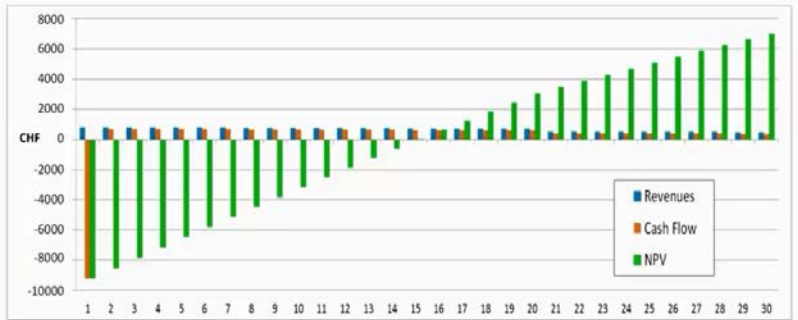
### Annual loss diagram



### System electric diagram



### FINANCIAL OVERVIEW



CAP-EX	9200 CHF	Feed in Tariff	0.15 CHF/kWh
OP-EX	100 CHF/y	Sell Tariff	0.08 CHF/kWh
WACC	2.5%	Buy Tariff	0.20 CHF/kWh
Years of operation	30	Self consumption rate	0.75
NPV	7000 CHF	LCOE	0.12 CHF/kWh
IRR	4.7%	Payback Period	15 y

# The Business Model

## Three major streams of revenue

### ❑ Base User/Installer licenses

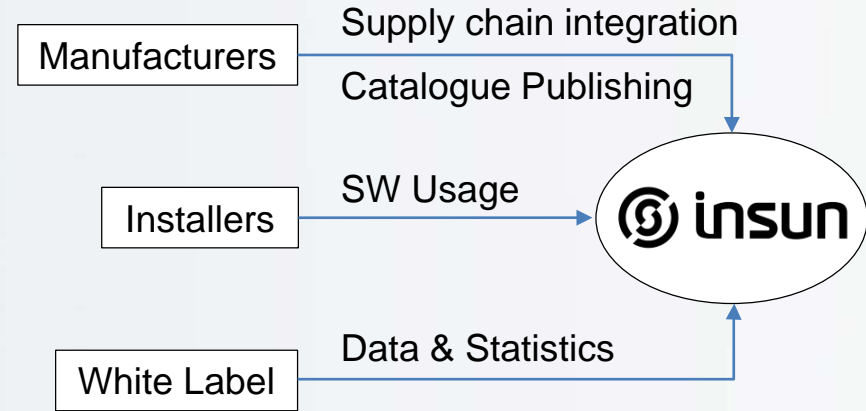
User login Software licenses

### ❑ PV Manufacturer Partnership

Product catalogue with company detailed data  
Sophisticated products price list management

### ❑ White Label Solution (WLS)

Platform embeddable into Customer web site



# Ongoing Project

## DESIGNPV – Optimization tool for PV Design

The project aims to develop a tool for the automatic optimization of the design process:

- Orientation of PV modules and definition of modules' strings
  - Minimization of cables length
  - Minimization of mismatch losses (accurate simulation)
  - Accurate comparison of different MLPE solutions
- 
- ❑ Collaboration with PV Lab and AI Lab of SUPSI
  - ❑ Financed by the Swiss Commission for Tech and Innovation

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**SUPSI**

**KTI/CTI**



**Thank you for your kind attention**

