



# Lowering LCOE with bifacial PV in Italy

**Power**ertis  
Power to the future

In 15 seconds, the Sun  
provides as much energy as  
humanity uses in a day...

At **PowerTis** we focus on  
making those seconds count





## 3 GW | 2023

-  1 GWp in operation in Brazil by 2023
-  1 GWp between Operation & Ready to Invest projects in Spain by 2023
-  1 GWp of Ready to Invest projects in Italy by 2023



## Emilio Marconell

### COO of Powertis

20+ years of experience in renewables projects.

Specialized in the development, consultancy, due diligence and M&A services of Renewables projects in Europe, America, Asia and Africa, with special focus in Latam.

The logo for Powerertis, featuring the word "Powerertis" in a bold, sans-serif font. The letter "w" is stylized with a teal-colored stroke that extends upwards and to the right, crossing the top of the letter "e".

**Powerertis**

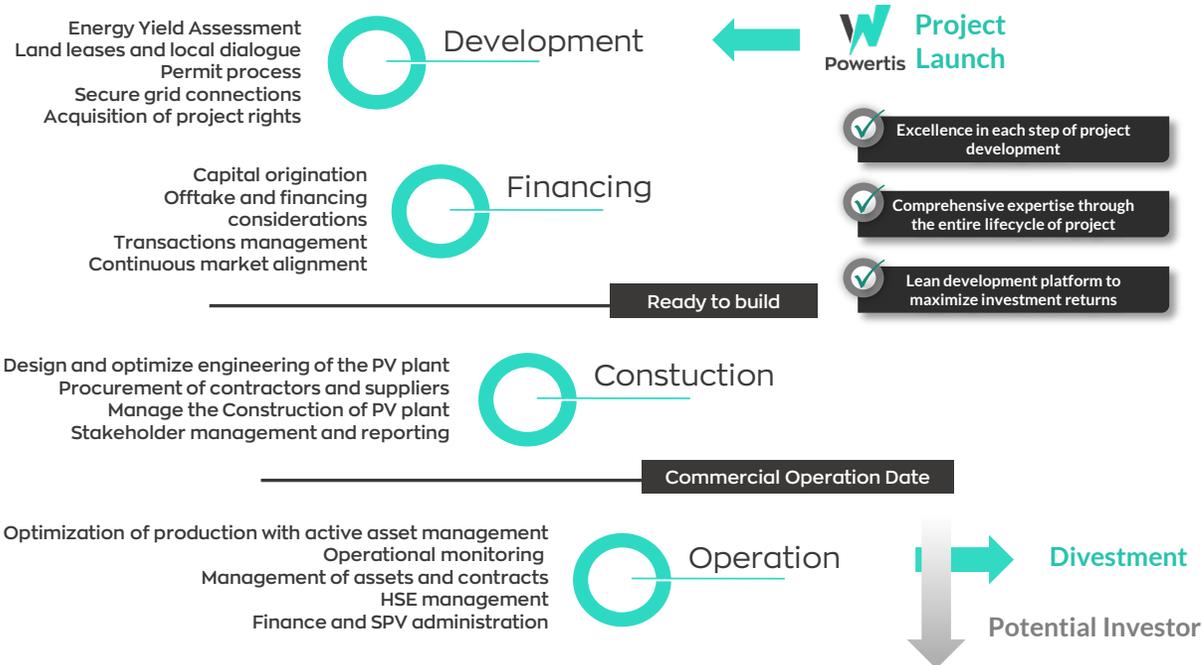
## **SECTION 1**

### **Powerertis and Soltec Overview**

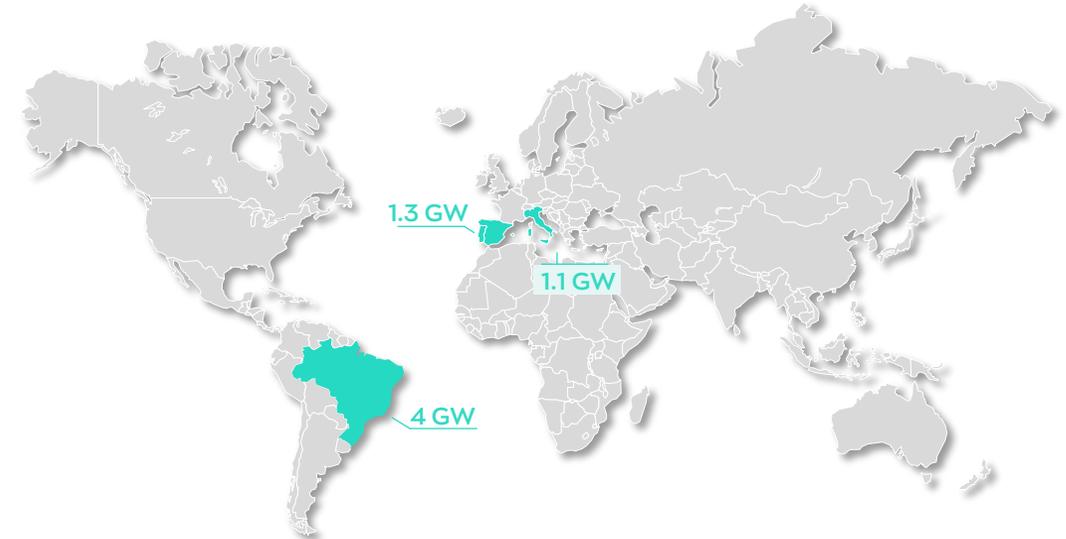
Powertis is a utility-scale solar developer and investment platform, set up with the mission to accelerate the adaption of solar PV in key markets through non-subsidized structures.

## Brief Overview

- Powertis develops greenfield projects in Spain, Italy and Brasil.
- Powertis capitalizes on Soltec's in-depth expertise and solid track record.
- Powertis' business model focuses on developing projects up to investment-ready status; i.e. all licenses obtained, EPC negotiated with key components secured, and PPAs and financing in place.



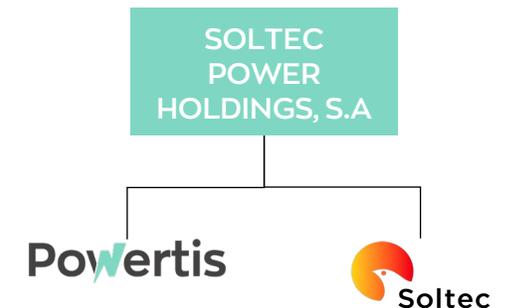
## Current Footprint



## Key Facts



## Ownership Structure



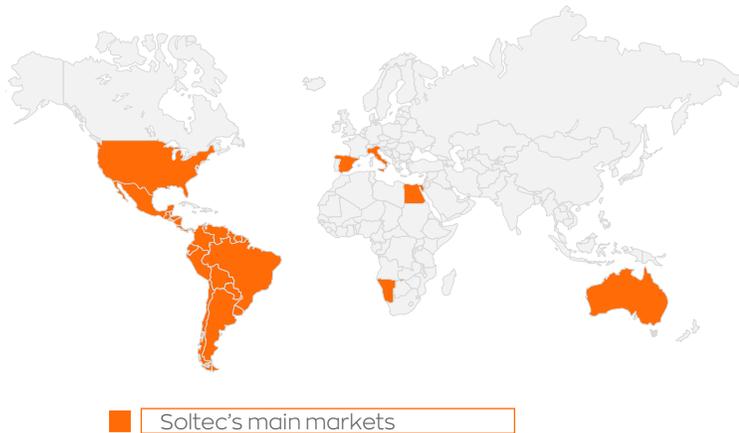
Powertis benefits from Soltec's in-depth expertise: a leading global tracker manufacturer and solar PV services provider with a proven track record globally since 2004.

## Overview: A leading solar tracking company

- 3rd tracker manufacturer globally<sup>(1)</sup> and 1st in LATAM
- 16+ years of experience in solar PV
- Integrated supplier, providing services across the value chain



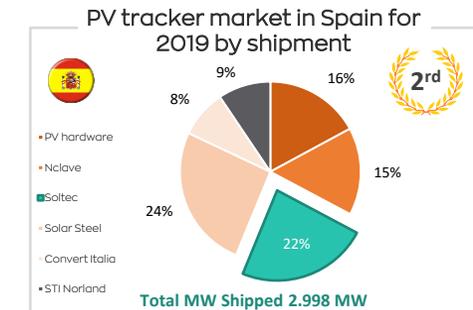
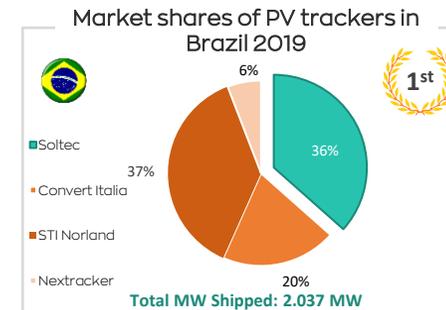
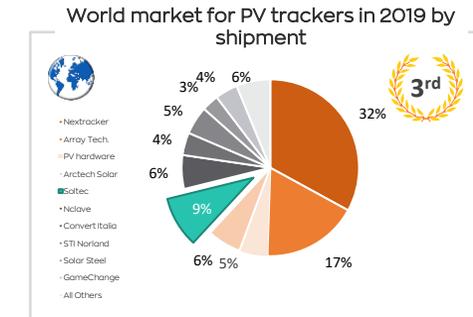
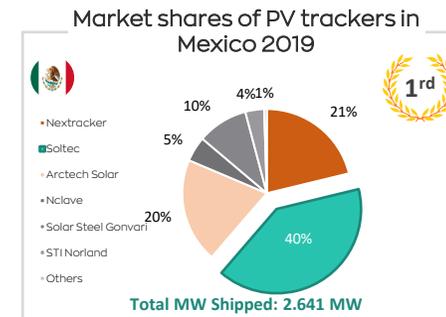
## Global & Diversified footprint with agreements with top tier companies



## Key Facts

Track Record ~8.6 GW	Backlog & Pipeline 2.1 GW	Manufacturing Capacity 20.0 GW	Employees Globally 1,315
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## Market Share in Selected Markets: #1 player in Brazil and Mexico, #2 in Spain



1. .... LCOE
2. .... Modules
3. .... Structures
4. .... Inverters
5. .... Albedo
6. .... Pitch
7. .... DCAC
8. .... PVsyst
9. .... Bankability

$$\text{LCOE} = \frac{\text{NPV (Capex + Opex + Financial Expenses - Incentives)}}{\text{NPV Generation}}$$

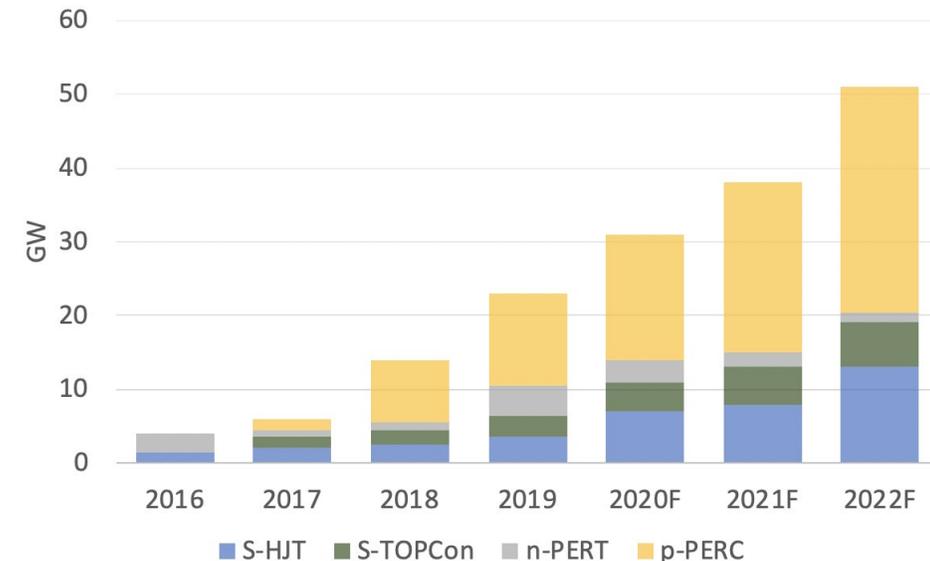
- Average cost of energy throughout the lifetime of Project.
- It improves by reducing numerator (cost) or increasing the denominator (generation).
- Reducing cost by maintaining same generation of monofacial system at lower DC
- Increasing generation compared to monofacial at a marginal price

## Modules technology

- Bifacial modules provide a boost in generation compared to monofacial with a minimum increase in Price.
- There are currently 3 main technologies in the market:
  - P-PERC: most common, smallest efficiency (20.5%), lowest bifacial coefficient due to some Aluminium on the back side (70-80%). Best price.
  - N-PERT: medium point in terms, efficiency (21%), bifacial coefficient (90%) and price
  - HJT: highest efficiency (21.5%), highest bifacial coefficient (90-95%). Highest Price
- Also concepts such as half-cells, improve efficiency by halving the current and therefore reducing Power loss.

As of today, to minimize LCOE it is recommended to use P-PERC modules

**BIFACIAL CAPACITY & ACTUAL DEMAND FORECAST**



# Maximizing production with bifacial: structure



## Structure technology

### Fixed tilt

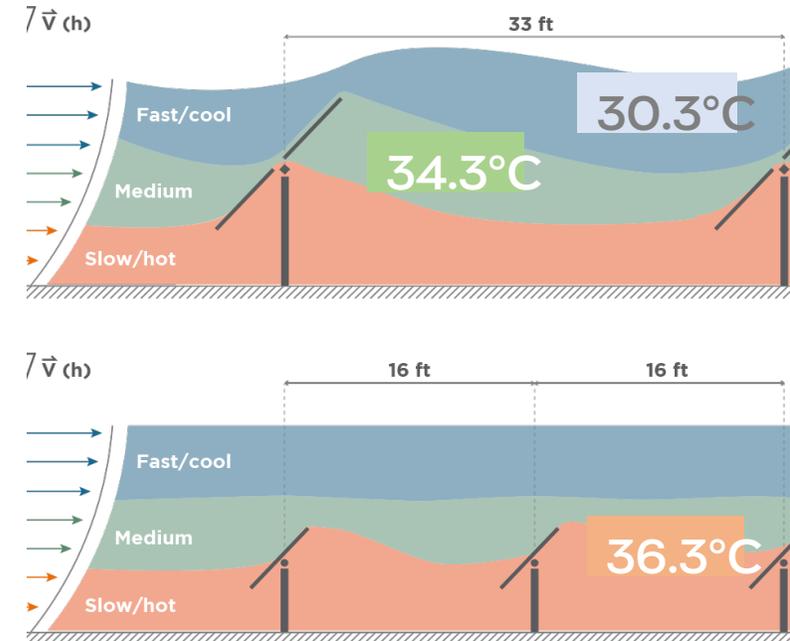
- Good solution for roof-top installations.
- Bifacial gain up to 15% compared to monofacial.
- Roof-top allows for easier installation of albedo enhancing material.

### Horizontal Single Axis tracker

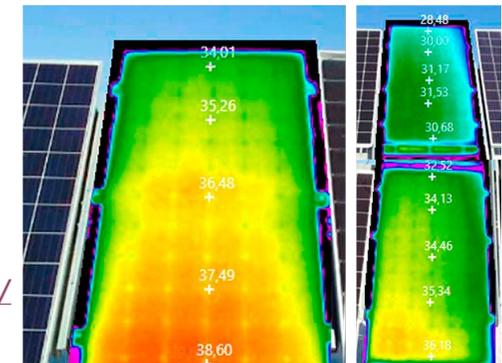
- HSAT + bifacial is a clear winner for ground mounted systems.
- Based on Bitec studies, Soltec SF7 2P tracker achieved a bifacial gain of 15.7% over high albedo conditions and 7.3% over low albedo.
- Regarding configuration, another Bitec study showed that 2P configuration outperformed 1P generation under same GCR and albedo by 2.1%.
- The main reasons:
  - A. Module height
  - B. Space between modules to avoid torque tube shadows and increase module cooling effects

From our point of view, to minimize LCOE it is recommended to use 2P trackers.

### 2P Vs. 1P tracker cooling



GCR 40%	Pitch	Temp. Average	$\Delta T$	$\Delta$ Ener gy
1P	5 m	33.96°C	3.52° C	2.1%
2P	10 m	30.44°C		



Soltec's Whitepapers <https://soltec.com/soltec-lab/>

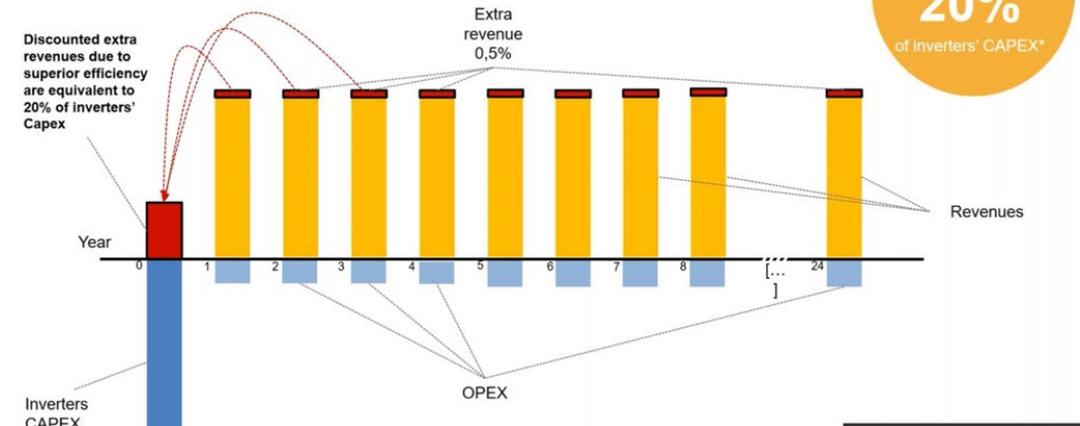
## Inverter technology

- Traditional approach to inverter selection:
  - String inverters below 20-40 MW
  - Central Inverters beyond 40 MW.
- However, this rule is changing.
- It is getting more and more common to see larger projects (>100 MW) with String inverters.
- Main reasons:
  - Slightly higher generation of String technology
  - Price reductions on string inverters closing the traditional gap
  - Increase in reliability and plug and play design translates into lower O&M
- At the same time Central inverters are releasing new concepts such as liquid refrigeration systems which claim to offer higher efficiency, increasing generation and reducing LCOE.
- As a reference, an extra 0.5% in efficiency is equivalent to 20% inverter capex

**We think there is no clear winner for Utility Scale, and all inverter technology should be analyzed without a preconceived opinion.**

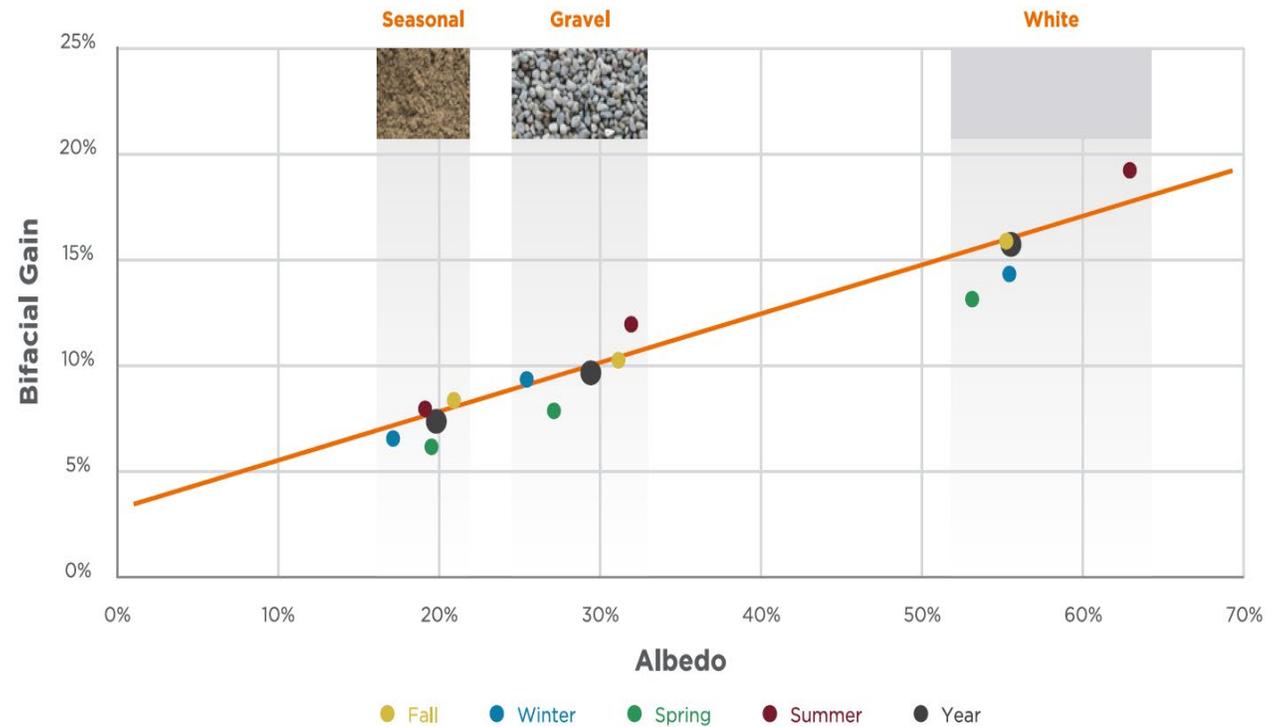
### Extra efficiency case study

An extra 0,5% in efficiency during lifetime is equivalent to 20% of Inverters Capex



$$\text{Albedo} = \frac{\text{Reflected Irradiance (RI)}}{\text{Global Horizontal Irradiance (GHI)}}$$

- Ground surface reflectance.
- Significant impact on generation.
- Lower albedo values bring a bifacial gain of 5-10%.
- Higher albedo values, bifacial gains can go up to 30%.
- Albedo is a complex matter which changes within the year and throughout the years.
- Efforts must be put in place to measure it properly due to:
  - Justify the value to lenders
  - You normally get a gain over satellite data

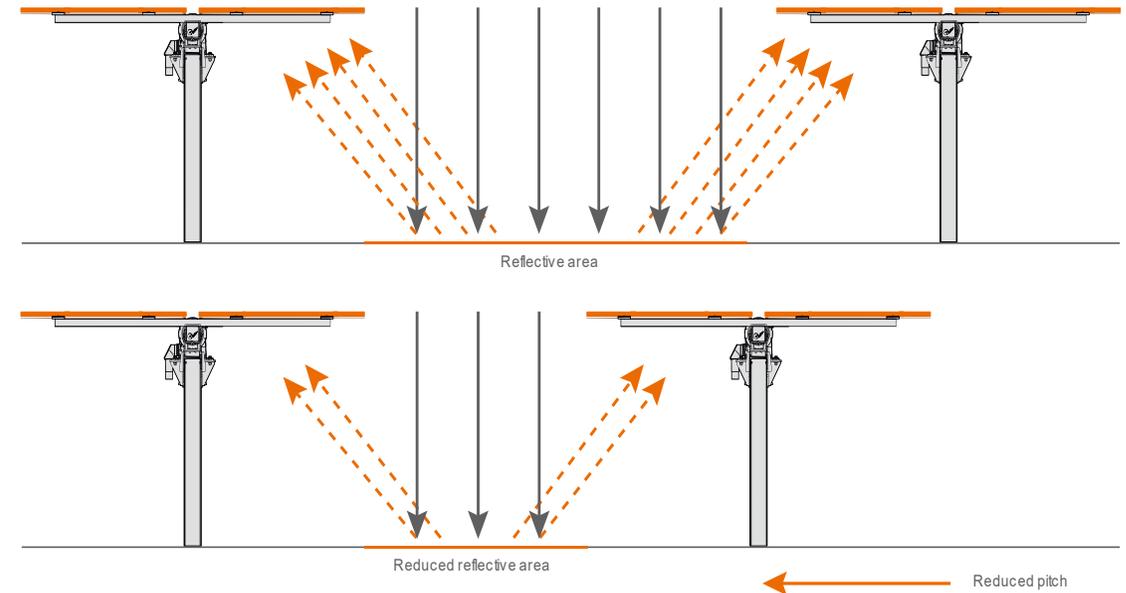
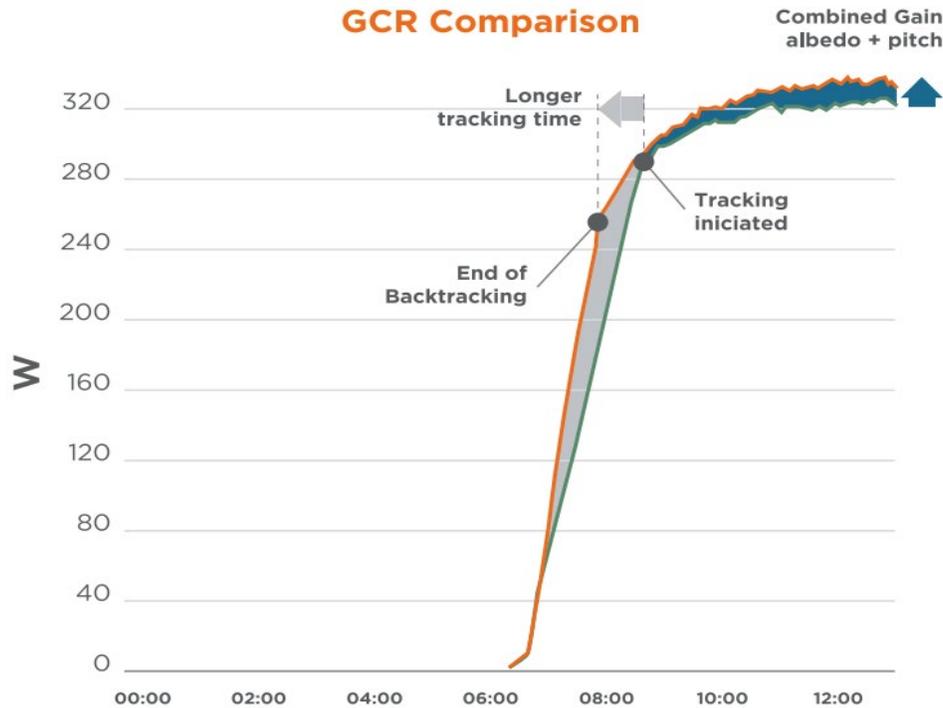


# Maximizing generation: Pitch



- Bifacial systems need higher pitch (lower Ground Cover Ratio) than monofacial ones so:
  - They extend the reflectance area, allowing more light to reflect from the ground to the back side of the module.
  - Allow more diffuse light to hit the back side
- By having a larger pitch, the system also benefits from an increasing tracking period, ie in the morning backtracking finish earlier and in the afternoon starts later

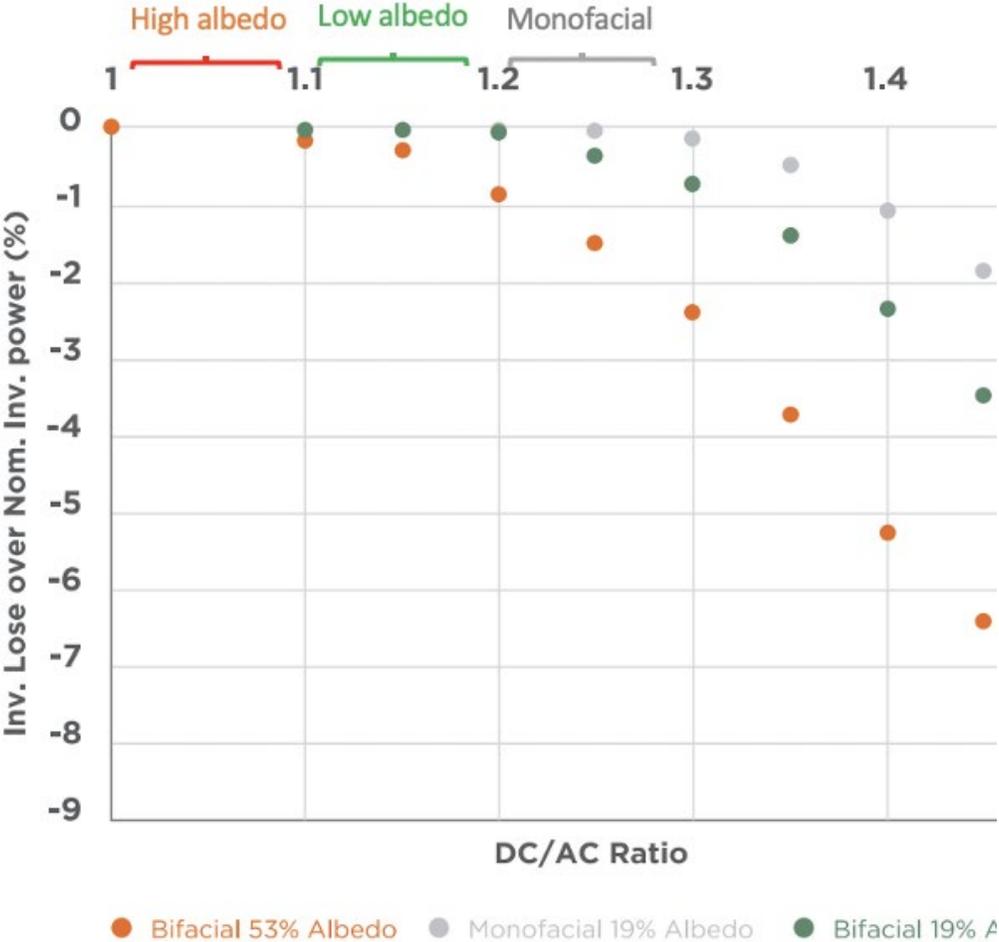
Pitch	8.7 meters	10 meters	12 meters
Bifacial Gain	9.49%	12.11%	14.58%
$\Delta$	-2,62%	Baseline	2.47%





## Key comments

- Backside power is not included in the module nominal power.
- Bifacial modules generate more energy than monofacial.
- Inverters receive more current.
- Inverters clip more.
- A lower DCAC is required.





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## PVSyst Assumptions

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- a) Long term database: Meteonorm vs SolarGIS.
- b) Thermal model.
- c) Rear shading.
- d) Albedo.
- e) Inclination.

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## Design

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- a) Module selection: P-type
- b) Tracker Selection: 2P with gap
- c) Inverter selection: Not clear technology. Analyze both.
- d) Overbuild (DCAC): lower overbuild values than with monofacial.
- e) Pitch: larger values than monofacial
- f) Albedo: run a campaign
- g) Select the right PVSyst assumptions to maximize generation (and you can justify)

- 1** Proven technology vs. State of the art
- 2** Off-taker bankability
- 3** PPA, EPC and main components contracts will be analysed
- 4** Lender technical advisors to Audit Developer's Resource Analysis Report and generate their own.
- 5** Focus on Albedo calculation and PVSyst assumptions.



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