
RENEERGY
by Asturmadi Group

RENEERGY

R - TRACKER

Identity

RENEERGY by Asturmadi Group S.L.

Photovoltaic Sector

Technical Team

Self Production

Garantee

+1.000 MW

+15 Years

+20 Countries

RENEWABLE ENGINEER ENERGY

Map

/ Internationals

Asturmadi RENEERGY S.L. has its origin and its main office in Avilés, Asturias, Spain.

We have other offices in Madrid, Sevilla, Mexico and Japan, having a representation of the company at strategic points for its expansion and developvent.

Our Agreement

/ Predesign

We take into account our client's requirements for create the best solutions.

/ Quality Control

Every manufactured element is checked according to a demanding quiality control both in our own manufacture process or in our suppliers.

/ Calculate & Design

We calculate and design our structures following the normatives of each countries so we achieve the optimal offer.

/ Transport

We send the produced elements in parcels taking care of its maintenance and good condition.

/ Production

We produce the pieces for the different structures in our factory or in collaborator companies.

/ Assembly & Supervision

We offer technical support during the assembly of the whole project. We can also do supervisions of the project.

High level of commitment to every phase of the project.

Products

/ Fixed Structure

Completely adjustable to the requirements of each project.

/ Trackers

R - Tracker offers solutions to achieve the maximum adaptability and the maximum profit according to our client's requirements.

- Typology 1V
- Typology 3H

/ Carport

Different architectural solutions for carpots.

- Simple
- Double
- For electric vehicles

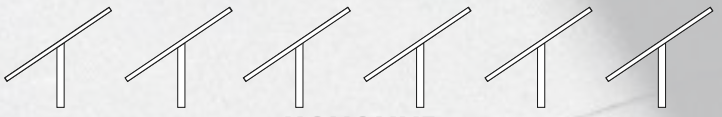
/ Roofs

Personalized solutions for each type of roofs.

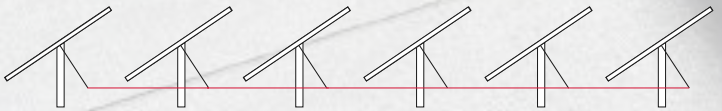
R - Tracker

1V

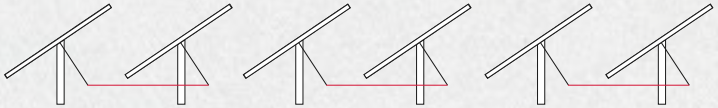
- Monoline
- Block — Multiline
- Biline



MONOLINE



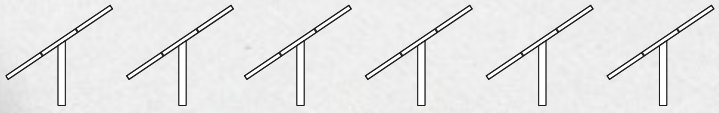
MULTILINE



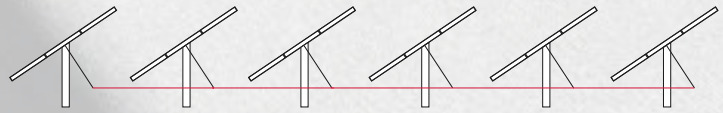
BILINE

3H

- Monoline
- Block — Multiline



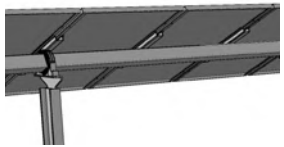
MONOLINE



MULTILINE

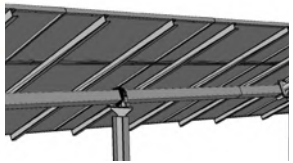
1V

1Vx60
11 Pillars
2 Trackers (3° y 9° Pillar)

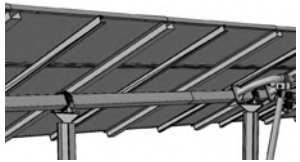


3H

3H Monofacial



3H Bifacial



3Hx28
9 Pillars
2 Trackers (3° y 7° Pillar)

MONOLINE

R - TRACKER

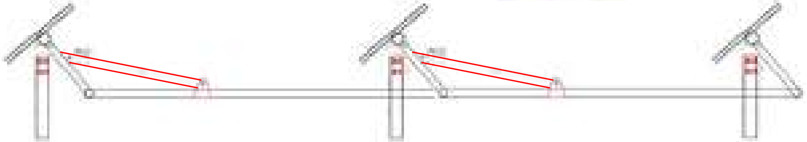
[illegible]	East - West ± 50° ; ± 55°
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	Configurable to the project
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

R - TRACKER

MULTILINE

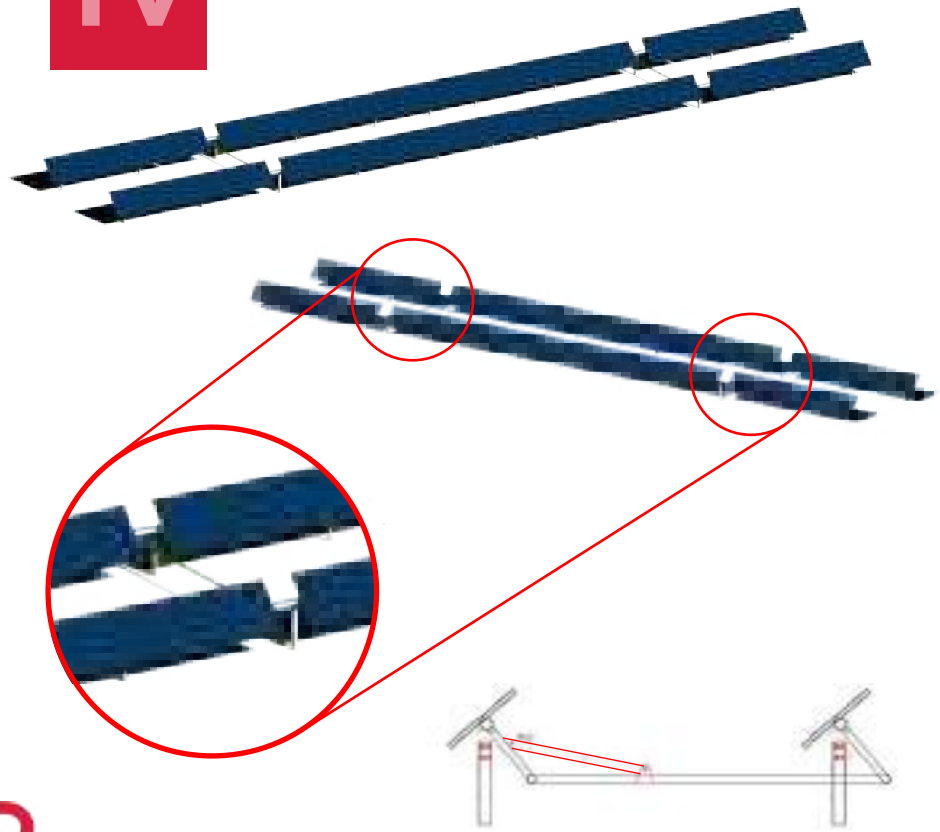
1V

3H



[illegible]	[illegible]
[illegible]	60
[illegible]	[illegible]
Modules	Monofacial / Bifacial
Drive Type	Linear Actuator
[illegible]	[illegible]
Material	[illegible]
[illegible]	[illegible]
Foundations	[illegible]
Wind Alarm	Configurable to the project
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
Tracking Algorithm	NOAA Astronomic Algorithm
Tracking Mode	Multibacktracking
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

1V



BILINE

R - TRACKER

[illegible]	[illegible]
[illegible]	60
[illegible]	2
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	Configurable to the project
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

R

Design

/ R - Tracker

We are constantly making tests and investing in innovation to achieve the best dimensioning for our trackers.

We do prototype and real size test in wind tunnel.

/ Pan-tilt Head

Pan-tilt with steel bracket.

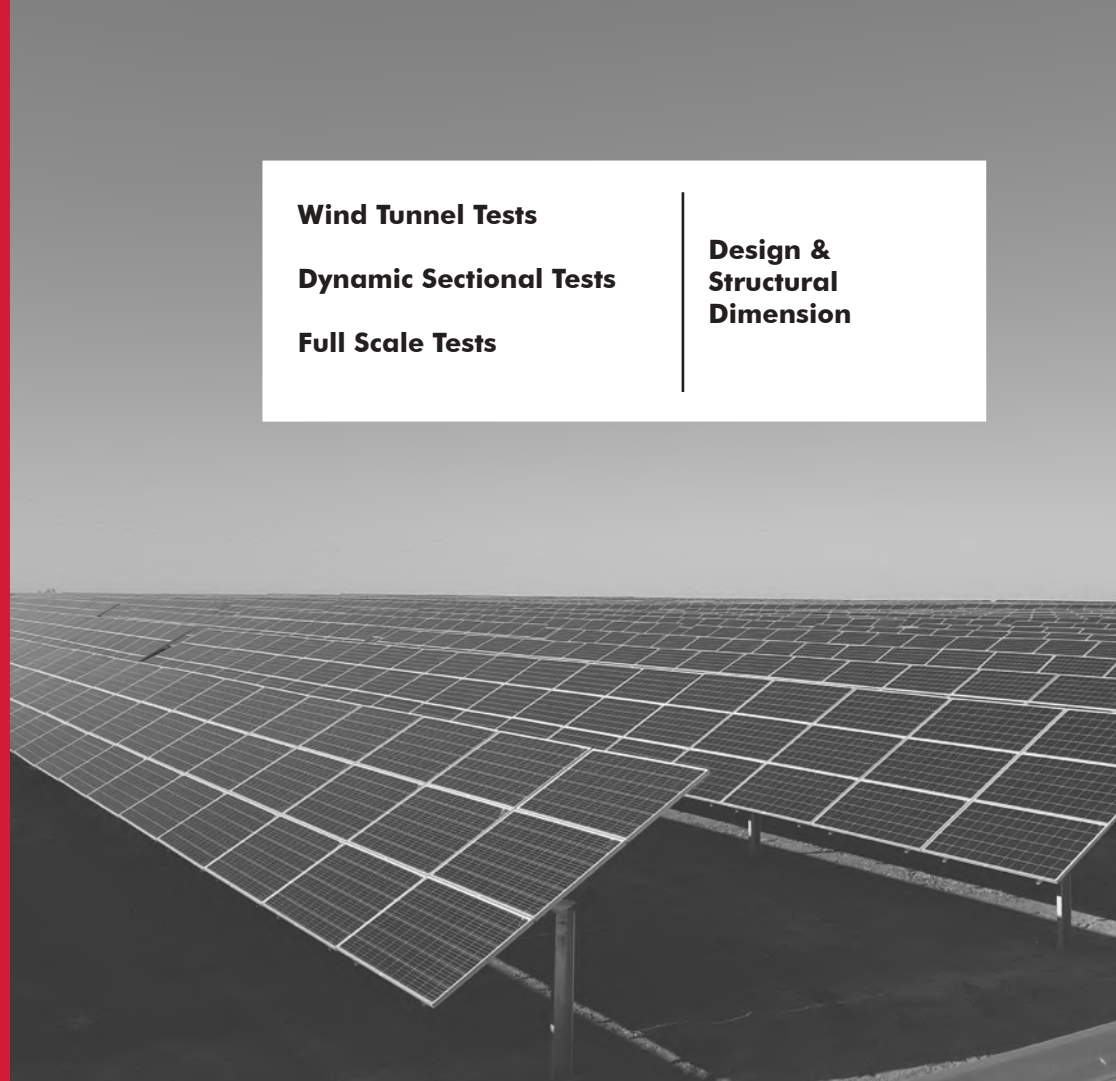
3D Pan-tilt which support high tolerances for the correct assembly of the pillars.

Wind Tunnel Tests

Dynamic Sectional Tests

Full Scale Tests

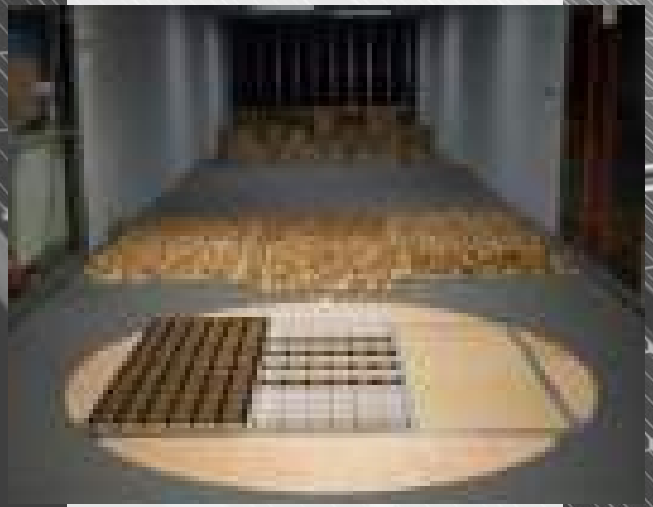
Design & Structural Dimension

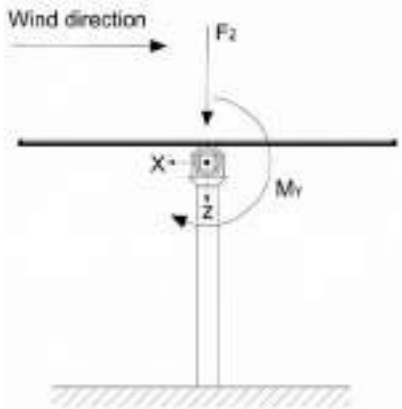


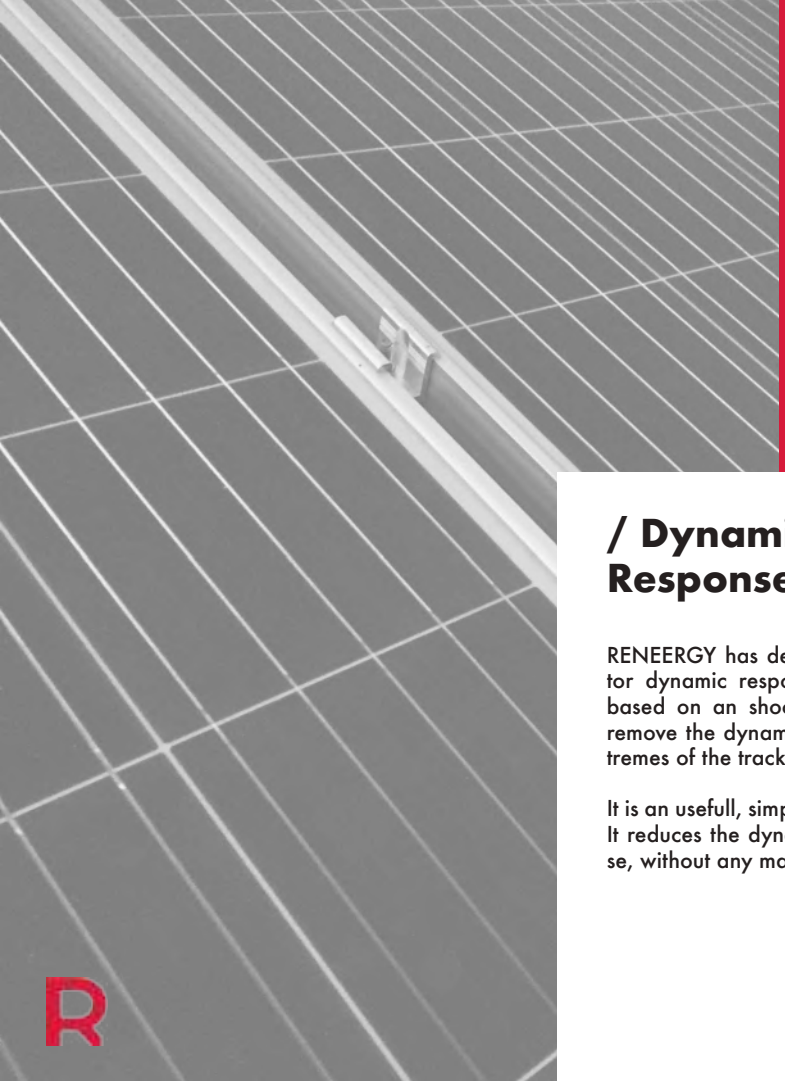
Static Wind Tunnel Test

/ Wind Tunnel

We get the incident pressures of the tracker for select the best dimension of each structural elements.







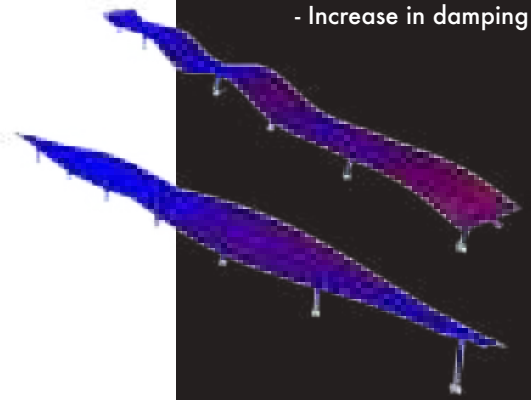
Dynamic Response Control System

/ Dynamic Response

RENEERGY has developed an innovator dynamic response control system based on an shock-absorbing, which remove the dynamic energy in the extremes of the tracker.

It is an usefull, simple and easy system. It reduces the dynamic torque response, without any maintenance.

- Removing of Dynamic Energy
- Reduce the dynamic torque response
- Increase in damping coefficient



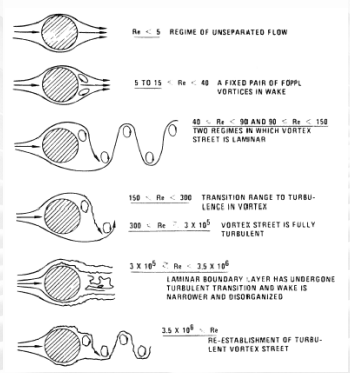
Sectional and Aerodynamic Drift Test

/ Structure

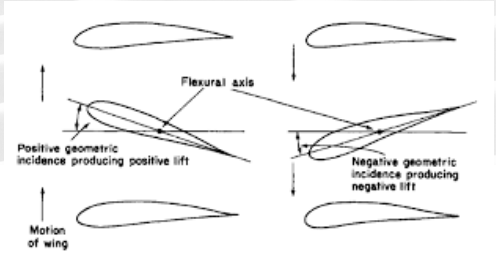
We study the different aerodynamic instabilities of the trackers.

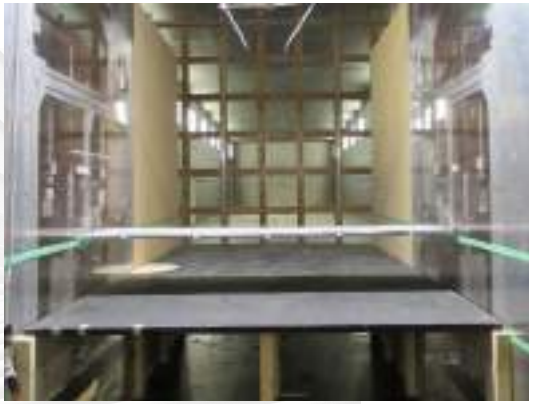
- Vortex
- Induced Vibration (VIV)
- Flutter
- Buffeting
- Galloping

Vortex



Flutter





/ Speed Results

Oritia & Boreas studied the crucial instabilities on different typoligies of racks.

We know the maximum wind speeds that each typology could resist. .

PROJECT	Study of the wind effects on photovoltaic tracker. Estimate critical instability windspeeds summary.
CLIENT	RENEERGY
CODE	REN01A02

Instability critical Windspeed estimates at 10 m - 0.3 m roughness length open country ten minutes mean								
	3x40 Exterior		3x40 Interior		3x60 Exterior		3x60 Interior	
	Flutter Instability		Flutter Instability		Flutter Instability		Flutter Instability	
	Smooth Flow	Turbulent Flow	Smooth Flow	Turbulent Flow	Smooth Flow	Turbulent Flow	Smooth Flow	Turbulent Flow
0	58,4	62,8	48,4	52,0	53,9	57,9	44,1	47,4
5	38,8	41,7	32,1	34,5	35,8	38,5	29,2	31,4
30	34,6	37,3	28,7	30,9	32,0	34,4	26,1	28,1
60	Not observed	Not observed	Not observed	Not observed	Not observed	Not observed	Not observed	Not observed
-60	Not observed	Not observed	Not observed	Not observed	Not observed	Not observed	Not observed	Not observed
-30	39,3	42,3	32,6	35,0	36,2	39,0	29,6	31,9
-5	43,7	47,0	36,2	38,9	40,3	43,3	32,9	35,4

	2x40 Exterior		2x40 Interior		2x60 Exterior		2x60 Interior	
	Flutter Instability		Flutter Instability		Flutter Instability		Flutter Instability	
	Smooth Flow	Turbulent Flow	Smooth Flow	Turbulent Flow	Smooth Flow	Turbulent Flow	Smooth Flow	Turbulent Flow
0	63,0	67,8	61,2	65,8	52,9	56,9	47,6	51,2
5	41,8	45,0	40,6	43,7	35,1	37,8	31,6	33,9
30	Not observed	Not observed	Not observed	Not observed	Not observed	Not observed	Not observed	Not observed
-30	62,3	67,0	60,5	65,1	52,3	56,2	47,0	50,6
-5	47,1	50,7	45,8	49,2	39,6	42,5	35,6	38,2

Full Scale Test

/ University of Oviedo

We check every structural calculations of each elements of the tracker in colaboration of the University of Oviedo.

- **Pan tilt Head Tests**
- **Actuator Tests**

/ Full Scale

Thanks to the numeric modeling by a finit element software, we simulate the displacements of eachh pant-tilt head to know its weaknest zones and how much these zones deform the tracker.

We also did shear, compression and drive tests.

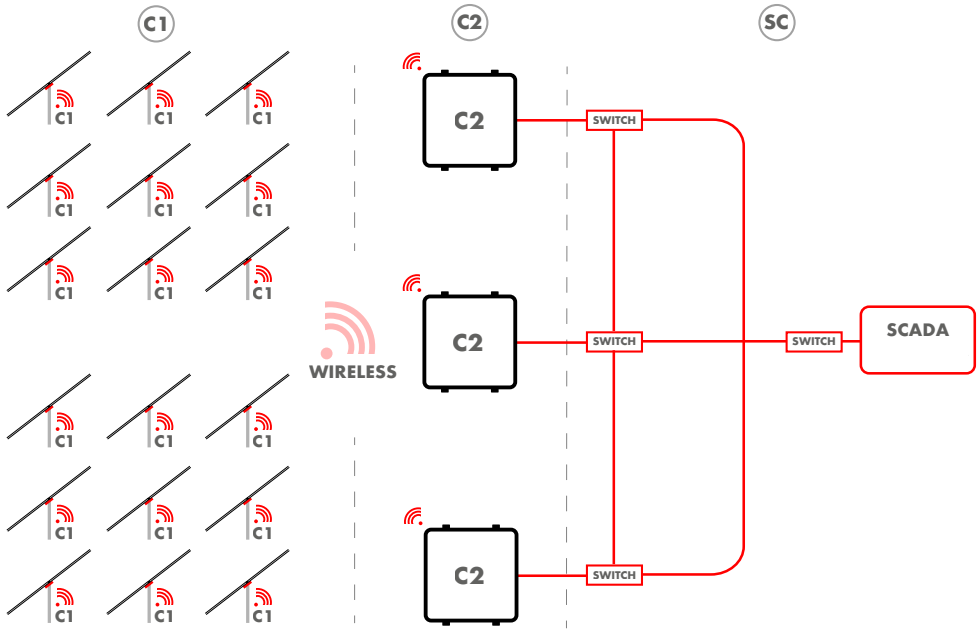
Control

/ Two levels of control

We install two levels of control. C1 id situated in each tracker with its own positioning sensor (inclinometer)

They are managed by C2 which comunicate C1 with SCADA.

The comunication between C1 y C2 will be Wireless (Zigbee)



Multi Backtracking

/ Effectiveness

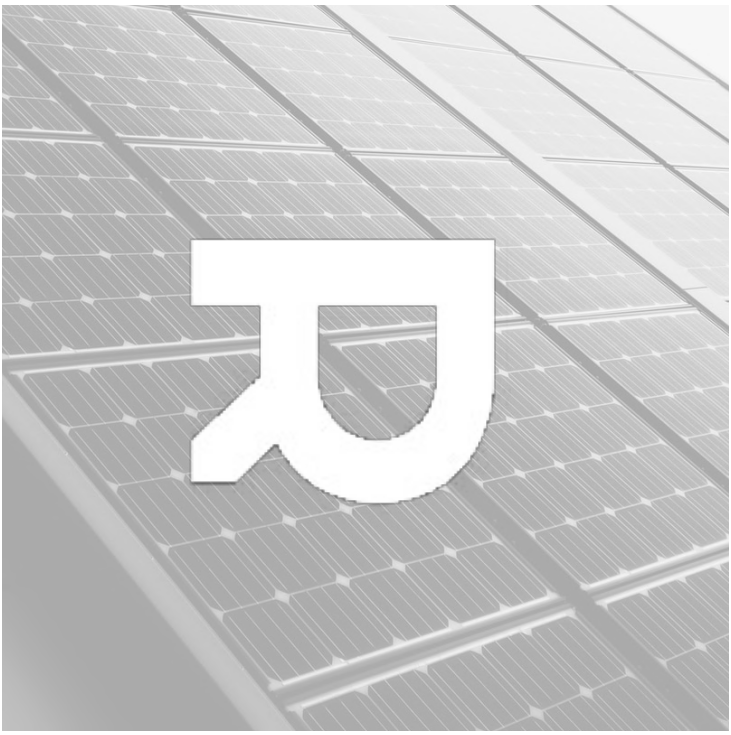
System which manage the shadows regulating the positioning of each one for avoid the shadow during the use.

Some trackers generate shadows to others due to their different slopes E - W or N - S or their differents heights.

The method for avoid these shadows is based on an algorithm which control the positioning of the surrounding trackers.

It allows changing the angle of the trackers for avoiding the shadows on the modules.

RENEERGY by Asturmadi Group



Rev.01

Presentation Solar Trackers
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