



RENEERGY

by Asturmadi Group



RENEERGY

- 1 - Identity
- 2 - Map
- 3 - Our Agreement
- 4 - Products

- 5 - R - Tracker
- 6 - Typologies
- 9 - Design
- 10 - Static Wind Tunnel Test
- 11 - Dynamic Response Control System
- 12 - Sectional and Aerodynamic Drift Test
- 14 - Full Scale Test
- 16 - Control
- 17 - Multi Backtracking

R - TRACKER

RENEERGY by Asturmadi Group

S.L.

Photovoltaic Sector

Technical Team

Self Production

Garantee

+1.000 MW

+15 Years

+20 Countries



Identity

**RENEWABLE
ENGINEER
ENERGY**

R

R

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.

/ Calculate & Design

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

/ Production

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

/ Quality Control

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

/ Transport

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

/ 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 carports.

- Simple
- Double
- For electric vehicles

/ Roofs

Personalized solutions for each type of roofs.



R - Tracker

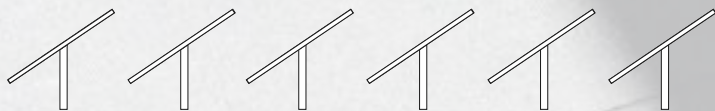
1V

- Monoline

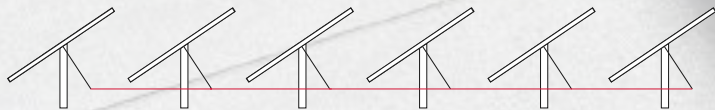
- Block

- Multiline

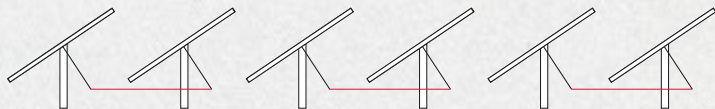
- Biline



MONOLINE



MULTILINE



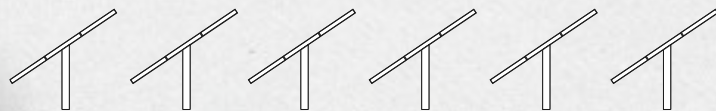
BILINE

3H

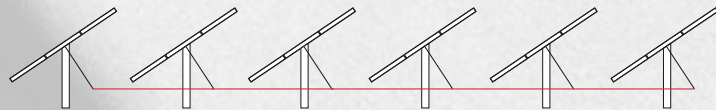
- Monoline

- Block

- Multiline



MONOLINE

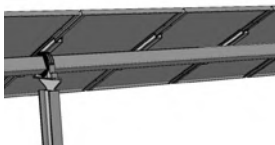


MULTILINE

1V



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



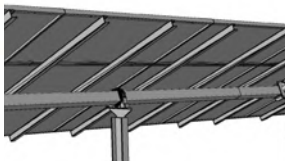
3H



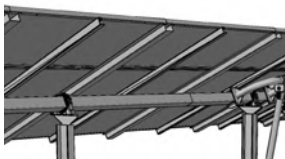
3Hx28
9 Pillars
2 Trackers (3° y 7° Pillar)



3H Monofacial



3H Bifacial



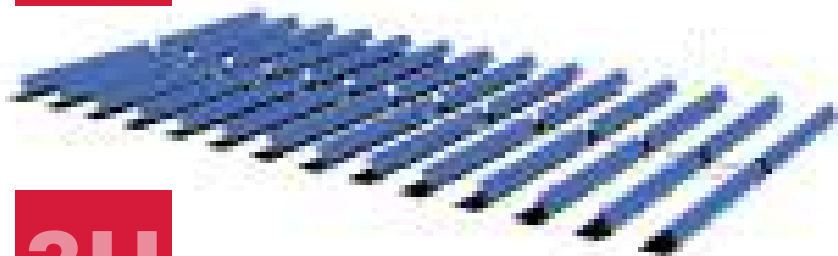
MONOLINE

R - TRACKER

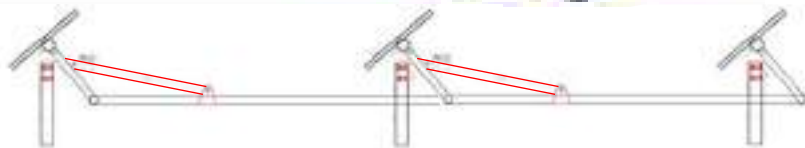
Tracking	East - West + 50° y - 55°
Line up Modules	Monocyl / Bi modules
Modules	monofacial / Bifacial
Drive Type	Linear Actuator
Axis	3D (High adaptability during assembly) West Control element from maintenance service
Material	Steel (Aluminum 6063 / 6061)
Building Foot (m)	Not by Manufacturer according to EN12-EN- 5011 and/or EN 10448 / EN 10340
Foundations	Drill and Fill / Concrete Foundation / Foundation Screw / Monopile
Wind class	Configurable to the project
Maximum Wind	Followed to local codes or specific conditions eg
Maximum Slope H/W	<ul style="list-style-type: none"> 3H For biggest slope are possible the following
Minimum Slope H/W	Any Slope
Tracking Algorithm	ACM4 Subarray Algorithm
Tracking Mode	Multi-tracking
Gate Field	Electric / RF / Digital
Maximum Voltage	150 VAC / 100 VDC
Busbar Material	Configurable depending on client request
Busbar Format	From 40 W to 100 W
Wire Section	Optimized Wire type L18 / Standard Wire 0
Modules (string)	Monocyl Clamps / Bolt

R

1V



3H



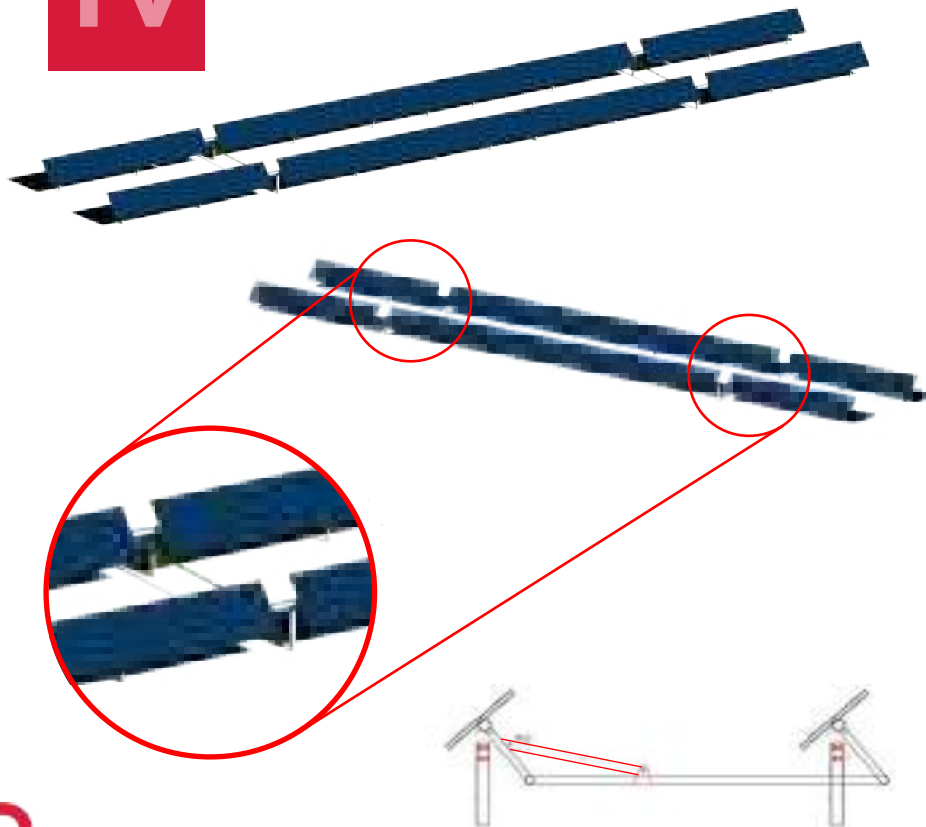
R

MULTILINE

R - TRACKER

Panel Tracking	East - West 110° (7.18°)
Maximum quantity of lines up	60
Maximum quantity of lines up	11
Modules	Monocrystalline / Bifacial
Drive Type	Linear Actuator
Warranty	25 (High adaptability during Assembly (Steel Structure) about 1000 maintenance points)
Material	Steel (Galvalume 5075 / 5055)
Roosting Exam [°]	Hot Dry (Galvalume) according to UNE - EN - EN 14343 or EN 14343 - EN 14343
Foundations	Galvanic / Concrete Foundations / Foundation Screws / Monopile
Wind Alarm	Configurable to the project
Maximum Wind	Refers to local codes or specific conditions up
Maximum Slope FLR	→ 10° (For bigger slopes see parameters (the solution))
Maximum Slope FLR	→ 10°
Tracking Algorithm	NEGA Automatic Algorithm
Tracking Mode	Multi-tracking
Drive Power	Electric / PV / Hybrid
Maximal Voltage	250 VAC / 250 VDC
Friction alarm	Configurable depending on client request
Alarm Power	From 0.75 kW to 2.00 kW
File System	Industrial File (type USB / Storage type C)
Module Settings	Scanned / Cloned / Real

1V



BILINE

R - TRACKER

Panel Tracking	East - West 110° (7.80°)
Maximum quantity of line up modules	60
Maximum quantity of line up	2
Modules	Monocrystal / Bifacial
Drive Type	Linear Actuator
Turn	90° (High adaptability during Assembly) Panel Range about 60m, maximum 100m
Material	Steel (Grade S235 / S355)
Rotating Speed [°]	100° Day (Optional) according to 1000 - 150 - 150° 1440° or 150° 1440° - 150° 1440°
Foundations	Galvan-Alloy / Concrete Foundations / Foundation Screws / Monopile
Wind Alarm	Configurable to the project
Alarmes Wind	Refused to local codes or specific conditions up
Alarmes High FLV	10° (For biggest angles are parameterized the rotation)
Alarmes High Low	10° - 30°
Tracking Algorithm	PIGA Automatic Algorithm
Tracking Mode	Autobalancing
Drive Power	Electric / PV / Hydrop
Maximal Voltage	250 Vdc / 350 Vdc
Friction alarm	Configurable depending on client request
Alarm Power	From 0.75 KW to 2.00 MW
File System	Integrated File (type USB / Storage type C)
Module Settings	Horizontal / Climb / Flat

■ 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.

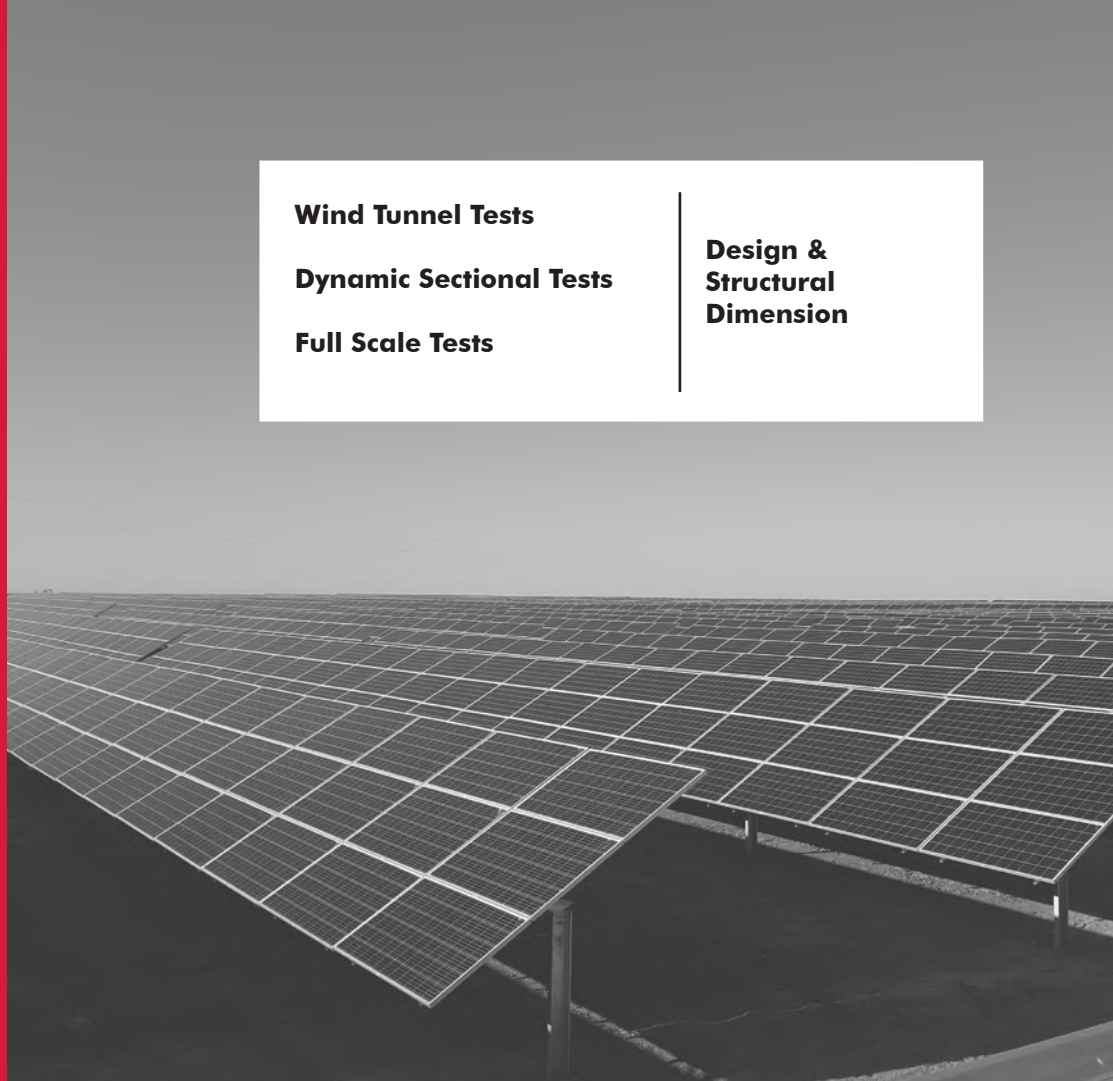
3D Pan-tilt which support high tolerances for the correct assembly of the pillars.

Wind Tunnel Tests

Dynamic Sectional Tests

Full Scale Tests

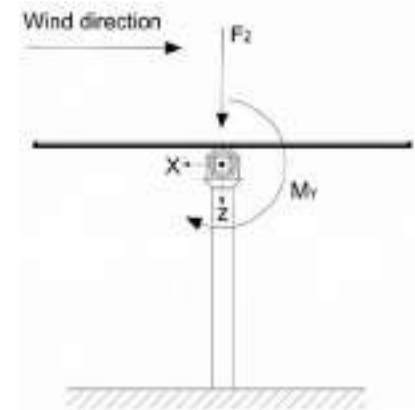
**Design &
Structural
Dimension**



/ Wind Tunnel

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

Static Wind Tunnel Test



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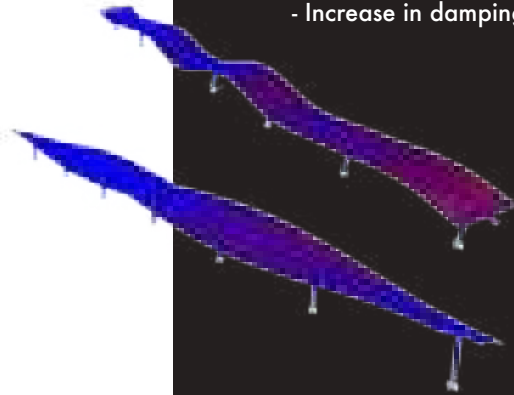
Dynamic Response Control System

/ 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



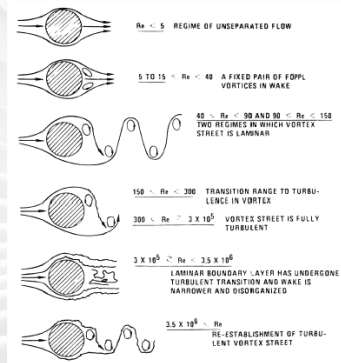
Sectional and Aerodynamic Drift Test

/ Structure

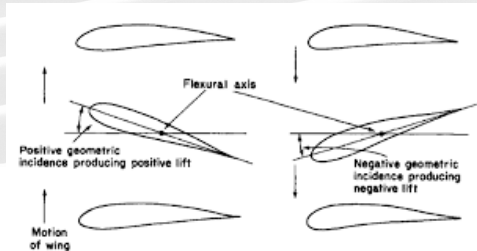
We study the different aerodynamic instabilities of the trackers.

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

Vortex



Flutter



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/ Speed Results

Oritia & Boreas studied the crucial instabilities on different typologies 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 cola-
boration of the University of Oviedo.

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





/ Full Scale

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

We also did shear, compression and drive tests.



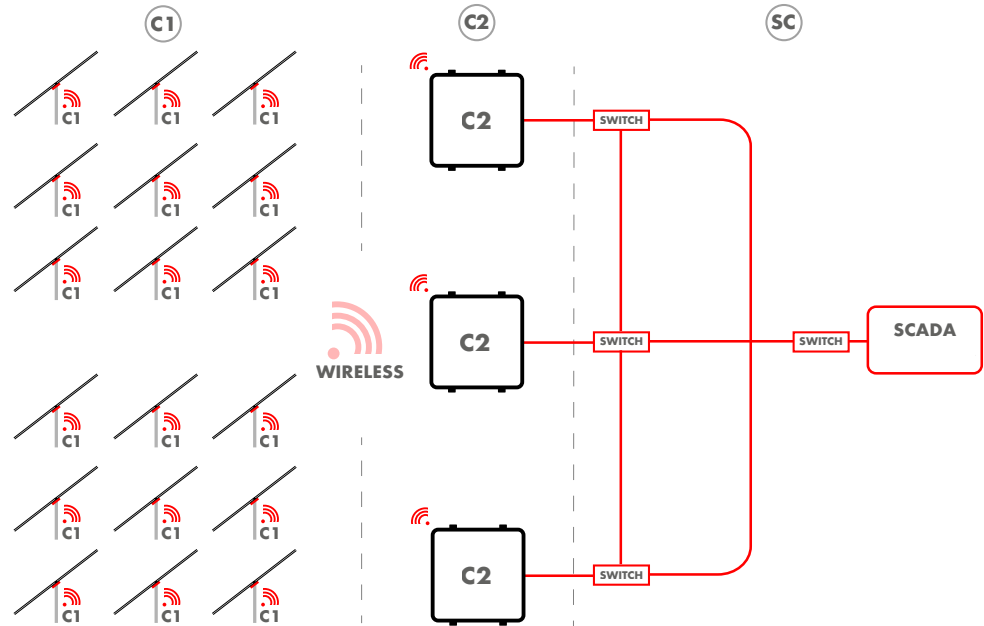
Control

/ Two levels of control

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

They are managed by C2 which communicates C1 with SCADA.

The communication between C1 and 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 different 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.





Rev.01