
Soltec
Making Tracks,
Building Trust

Introduction – Miguel Pozuelo

miguel.pozuelo@soltec.com
www.linkedin.com/in/mpozuelo

Miguel holds a double-degree in Industrial Engineering and Energy & Environmental Eng. as well as an MSc in Sustainable Energy Systems.

In his 5 years at **Soltec**, he has dealt with roles in product management, project engineering, business development and sales management.

Currently, as **Key Account Manager for MENA**, Miguel is supporting Soltec expansion in this strategic market.

Content

Integrating Bifacial PV trackers and automated cleaning at extreme desert locations

1. **Soltec** and the increasing importance of bifacial PV trackers
2. **Albedo**, a goldmine in the desert
3. **Atmospheric Corrosion**, the forgotten one
4. **Wind Definition**, the importance of accuracy
5. **Automated Cleaning Integration**, minimizing its CAPEX

1. Soltec and the increasing importance of PV trackers

16-year experience with solar trackers (since 2004)

1,600+ employees

13 international offices

10+ GWp cumulative sales

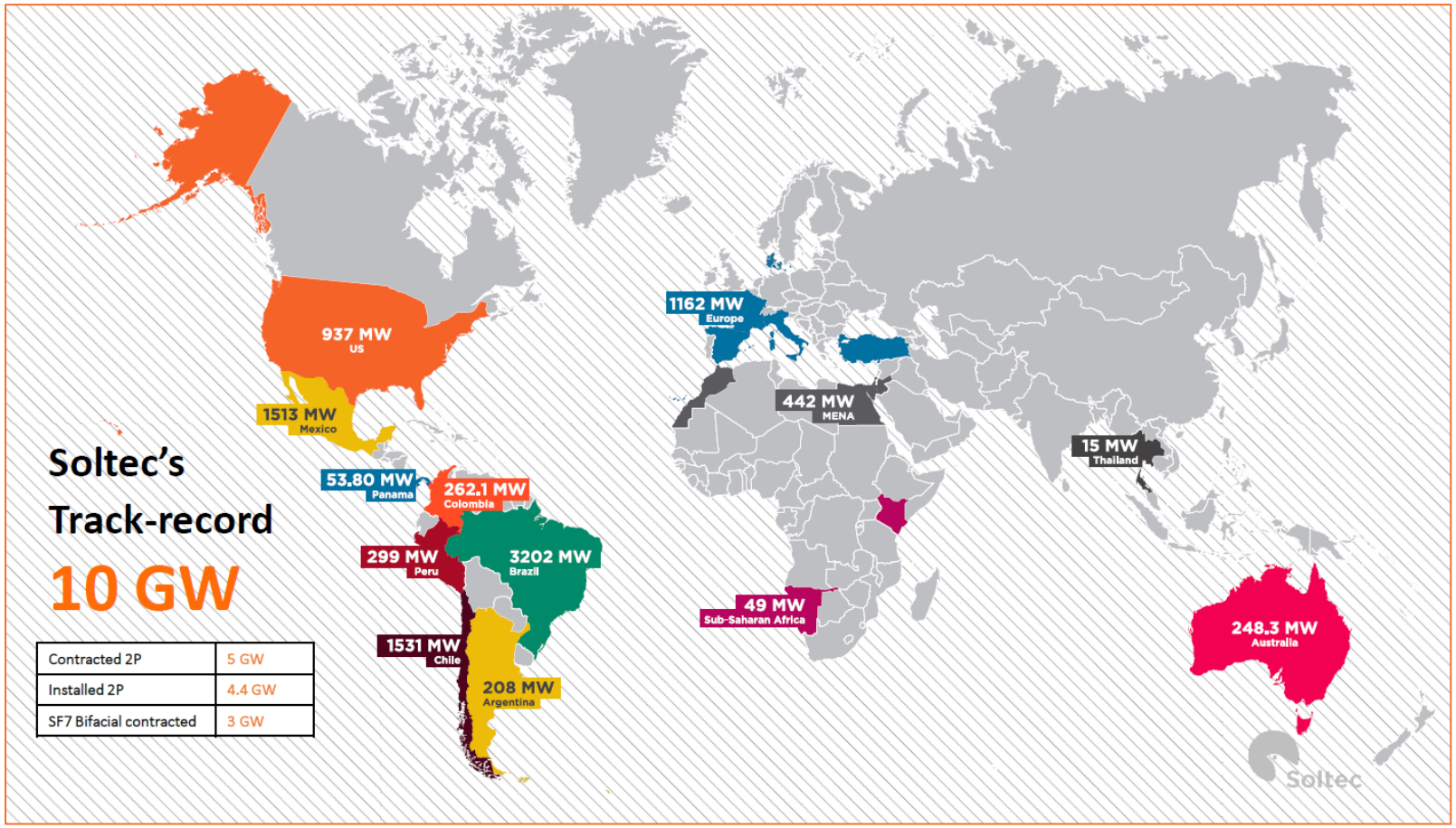
3+ GWp bifacial sales

1.1GWp bifacial shipments

#1 cumulative sales **LATAM**

#1 cumulative sales **Europe**

#1 2P tracker sales Worldwide



The crucial role of Single-Axis trackers:

I. It is the **Main Support** of the PV plant:

- Supports PV modules
- Supports soil foundation & corrosion risks
- Supports climate threats

II. It is the only element of the PV plant **Specifically Designed** for that site

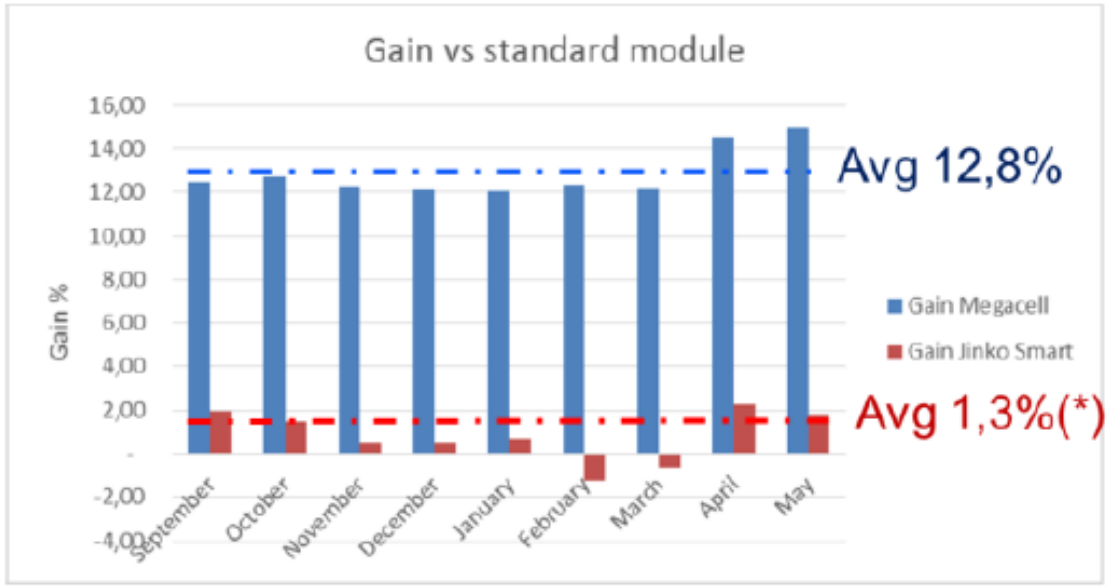
III. Compared to fixed structures, it **Increases Performance** by 15-25% and up to 35% when combined with bifacial technology

2. Albedo, a goldmine in the desert

First experience of utility-scale bifacial single-axis tracking:

Atacama Desert, Chile (2015): 1.7 MWp

First bifacial single-axis tracker specifically designed to boost bifacial gain: 2P configuration and no rear shading.



Monthly energy gain of bifacial PV modules compared to monofacial PV modules.

A.Di Stefano, G. Leotta, F. Bizzarri. "La Silla PV plant as a utility-scale side-by-side test for innovative modules technologies". 33rd European Photovoltaic Solar Energy Conference and Exhibition EUPVSEC2017 September 2017 Amsterdam. Proc 6CO.14.1 p.p 1978 – 1982, online reference: https://www.eupvsec-proceedings.com/proceedings?paper=44211

Main Challenges:

I. Collect **long-term measurements**

II. Simulate utility-scale **bifacial** PV plant **behavior** with 1P and 2P trackers

III. **Essay main factors** that impact in bifacial gain: *Albedo, GCR, Height, Rear Shading and Cell Temperature.*

Whitepapers available at *soltec.com/soltec-lab/*

BiTEC (Bifacial Tracking Evaluation Center)

Opening: July 2018 in Livermore, California.

Partners: Black&Veatch, NREL, RTEC, Jinko Solar, Canadian Solar, Longi, Hanwha Qcells, LG, REC

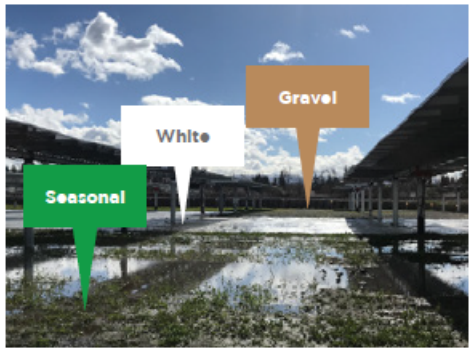


Figure 3. Trackers under different albedo conditions at BiTEC. Dirt test

In Blue: Modules used for measurements

In White, Brown and Green: White, Gravel and Seasonal albedos respectively

In Red: Aisle Pitch in meters:

2P - 12.0, 10.0 and 8.7 meters equivalent to a GCR of 0.33, 0.40 and 0.46 respectively

Albedo		Ground Coverage Ratio		
		0.46	0.40	0.33
White	49-65%	2P/1P		
Gravel	24-36%	2P	2P	2P
Seasonal	16-23%	2P/1P		

Table 1. Scenarios analyzed at BiTEC. Source: Soltec

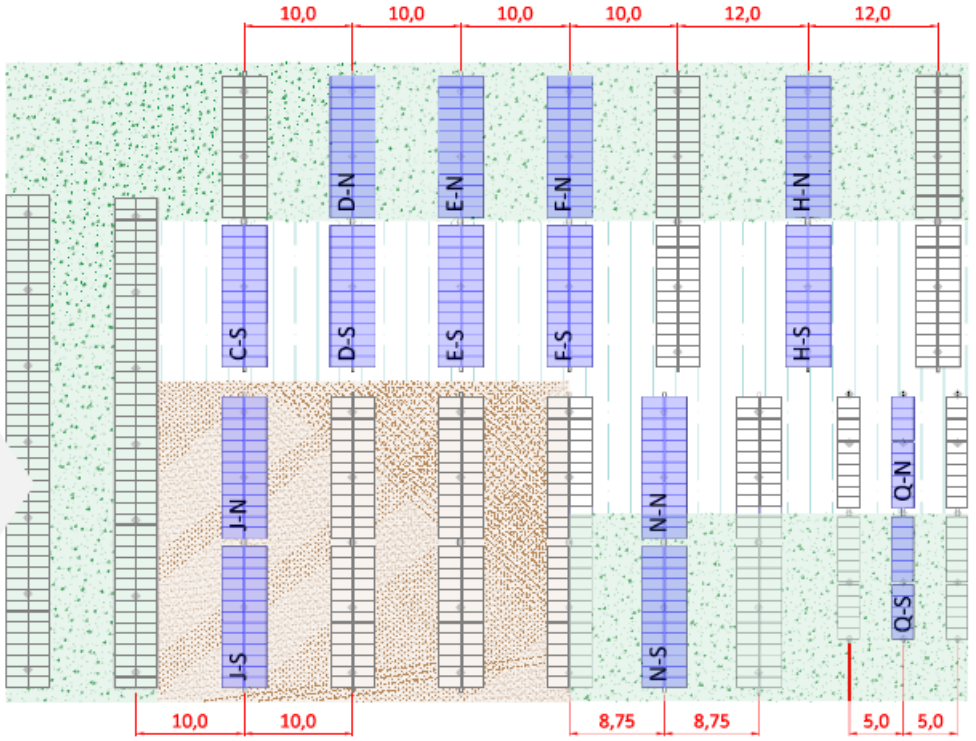
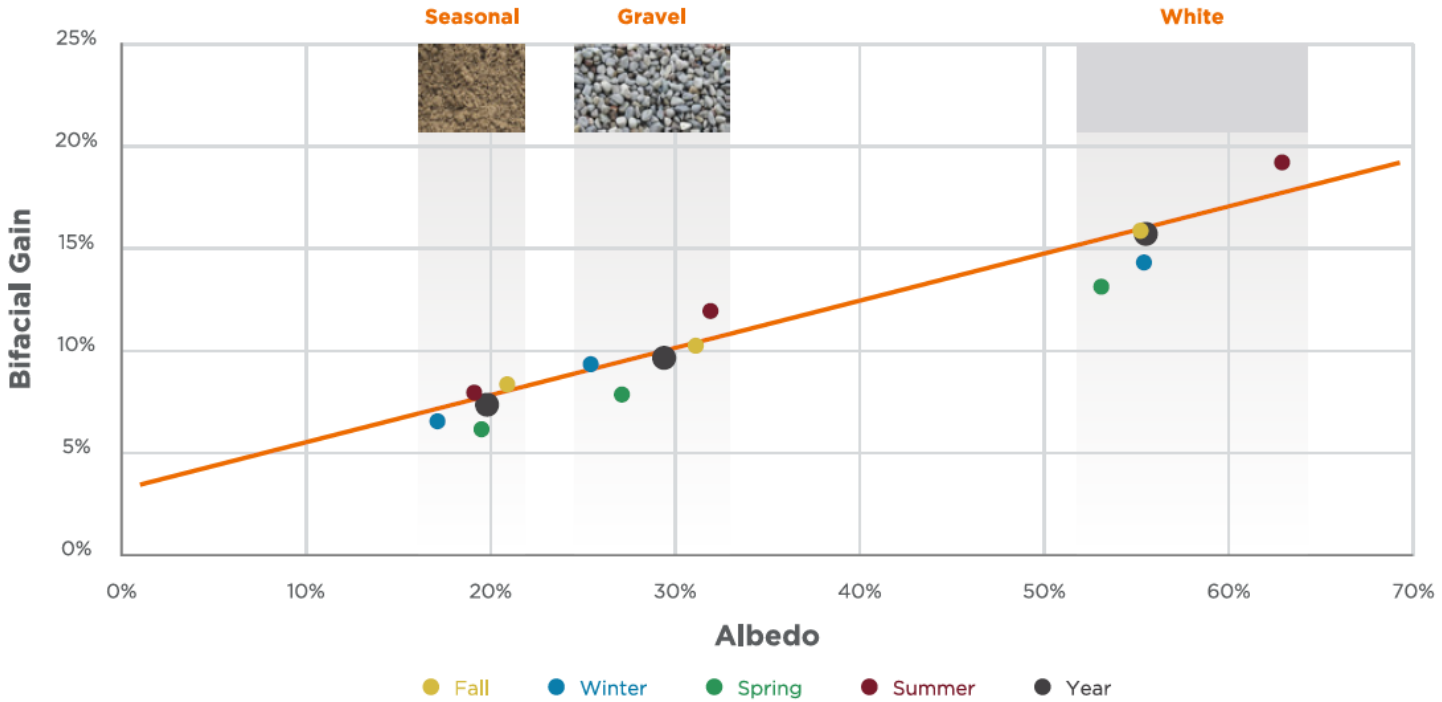
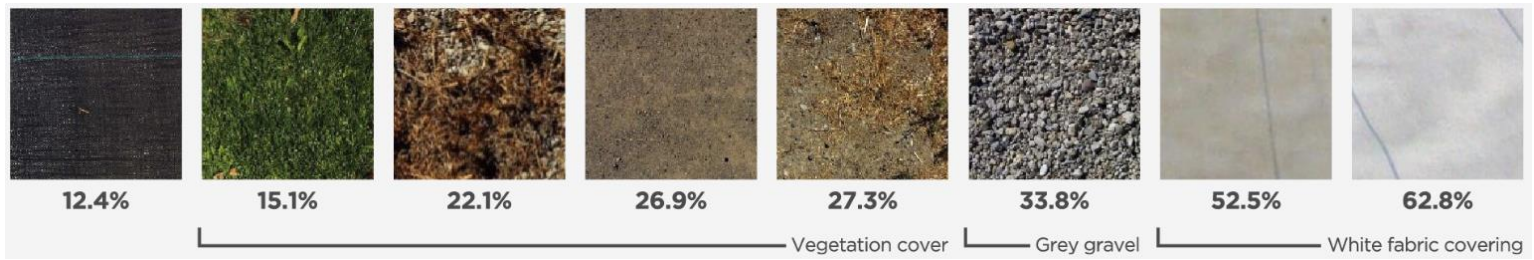
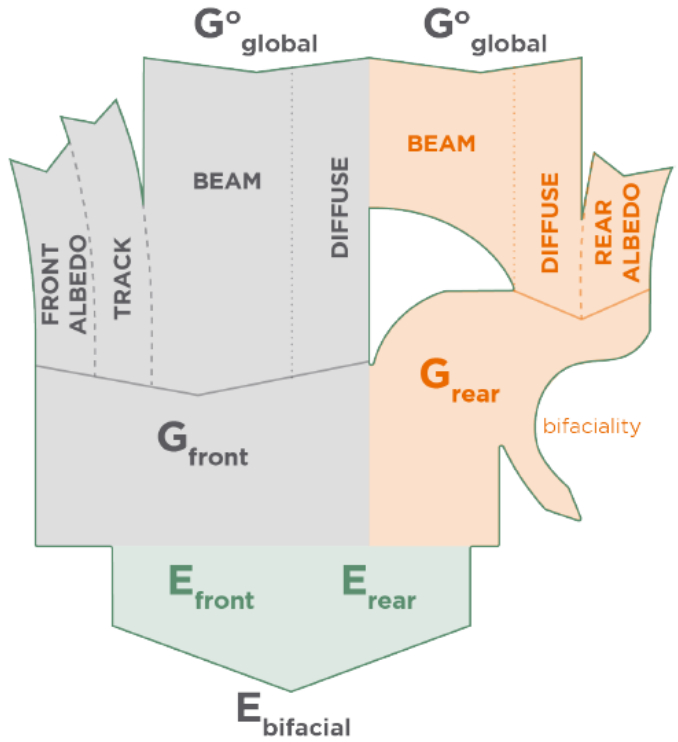


Figure 4. Layout BiTEC. Source: Soltec

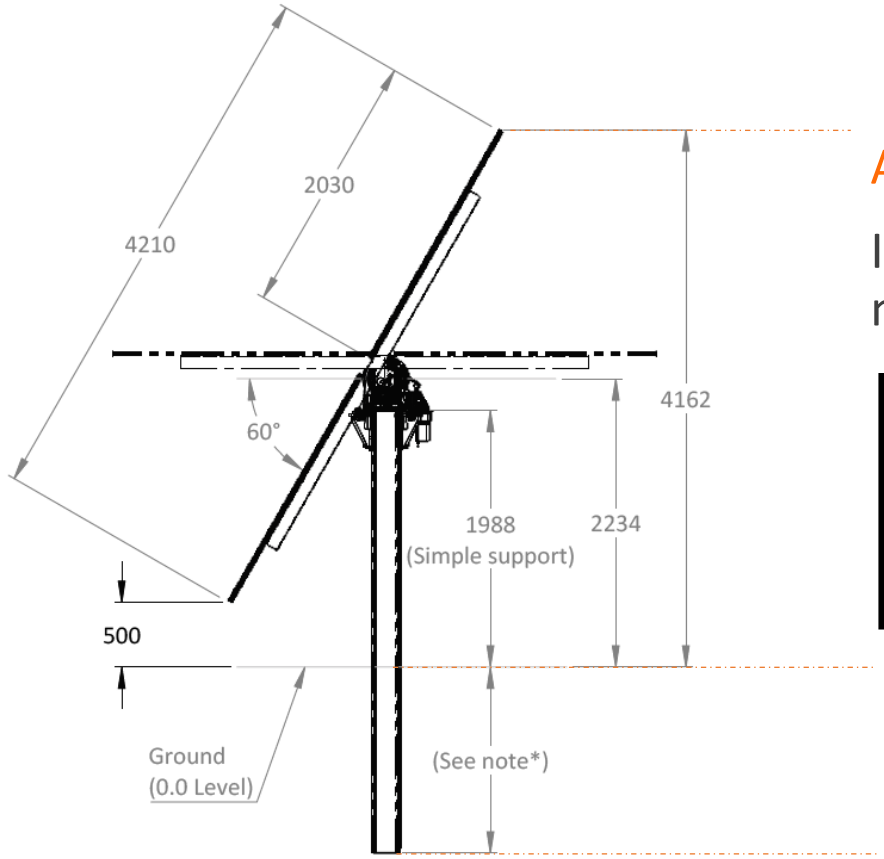
Albedo Influence on Bifacial Gain







3. Atmospheric Corrosion, the forgotten one



Atmospheric corrosion:

Impact on all components, accurate definition requires 12-month exposition analysis according to ISO 9223

Metal	Steady-state corrosion rate, r_{lin}, estimated as the average corrosion rate during the first 30 years for the following corrosivity categories					
	C1	C2	C3	C4	C5	CX
Carbon steel	$r_{lin} \leq 0,3$	$0,3 < r_{lin} \leq 4,9$	$4,9 < r_{lin} \leq 10$	$10 < r_{lin} \leq 16$	$16 < r_{lin} \leq 39$	$39 < r_{lin} \leq 138$
Zinc	$r_{lin} \leq 0,05$	$0,05 < r_{lin} \leq 0,4$	$0,4 < r_{lin} \leq 1,1$	$1,1 < r_{lin} \leq 2,2$	$2,2 < r_{lin} \leq 4,4$	$4,4 < r_{lin} \leq 13$
Copper	$r_{lin} \leq 0,03$	$0,03 < r_{lin} \leq 0,2$	$0,2 < r_{lin} \leq 0,4$	$0,4 < r_{lin} \leq 0,9$	$0,9 < r_{lin} \leq 1,8$	$1,8 < r_{lin} \leq 3,2$

Soil corrosion:

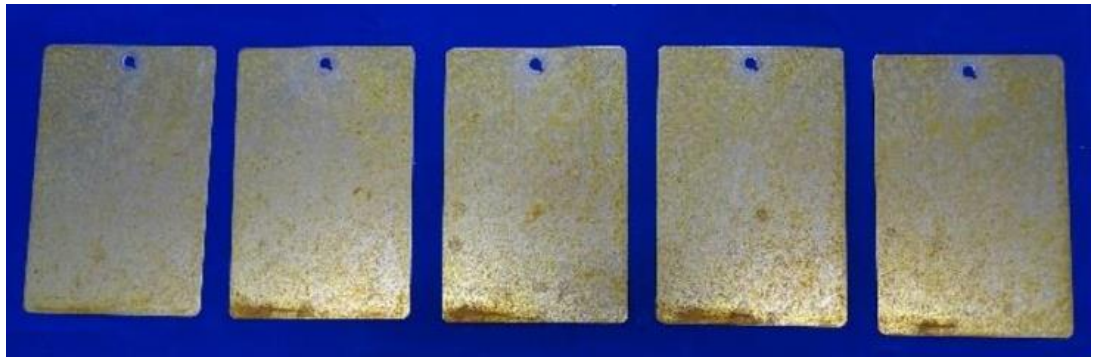
Impact on embedded pile, based on chemical content and resistivity obtained during geotechnical campaign

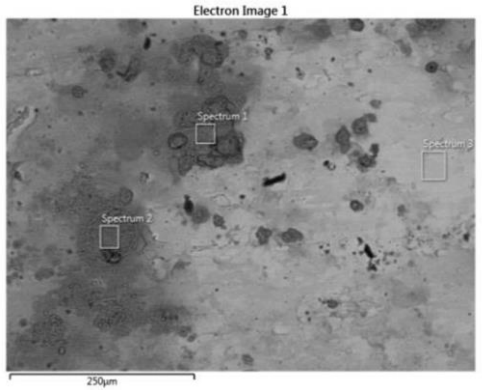
Standard Test for Atmospheric Corrosion Determination:

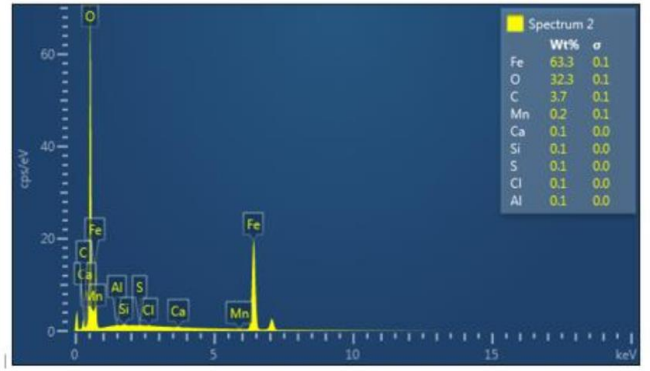
- **ISO 9223** *Corrosion of metals and alloys — Corrosivity of atmospheres — Classification, determination and estimation*

- **ASTM G50-10** *Standard practice for conducting atmospheric corrosion tests on Metals*

- **ASTM G1-03** *Standard Practice for Preparing, Cleaning and Evaluating Corrosion Test Specimens*

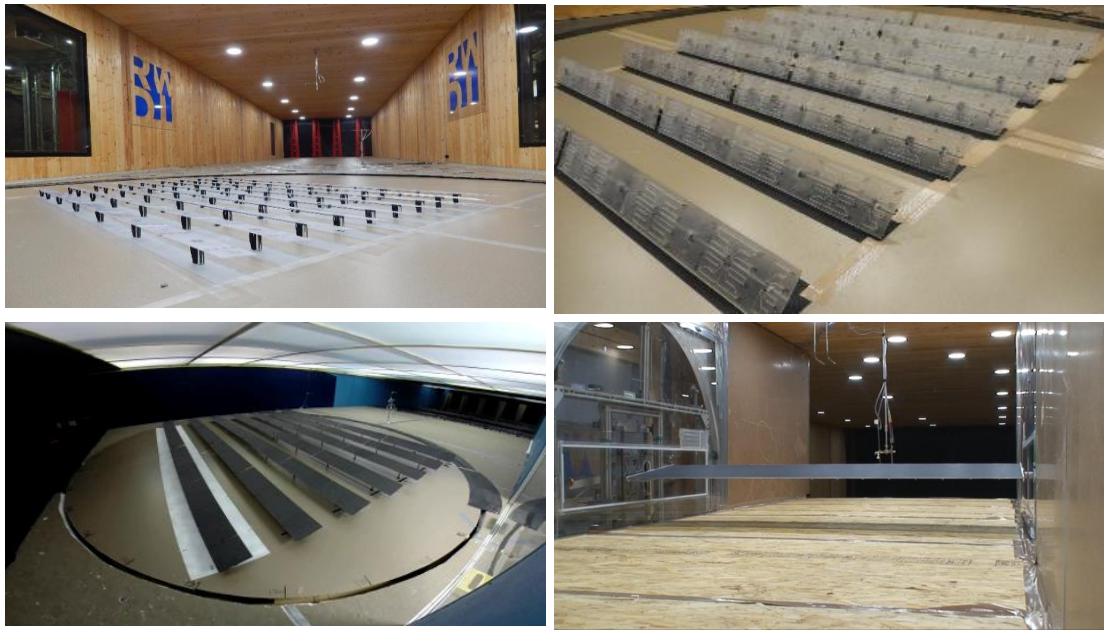






4. Wind definition, the importance of accuracy

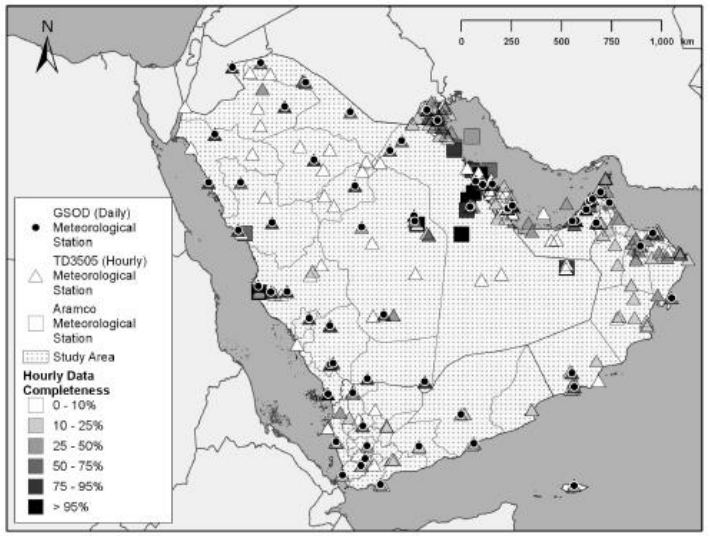
- Maximum wind speed is one of the **main drivers** of tracker structural design
- Accurate wind speed definition will lead to **safe** and **cost-effective** design
- **Sources** of maximum wind speed:
  - Local weather station with long-term wind gust data
  - Interpolation between several weather stations in a low distance to project
  - Weather Research and Forecasting (WRF) model

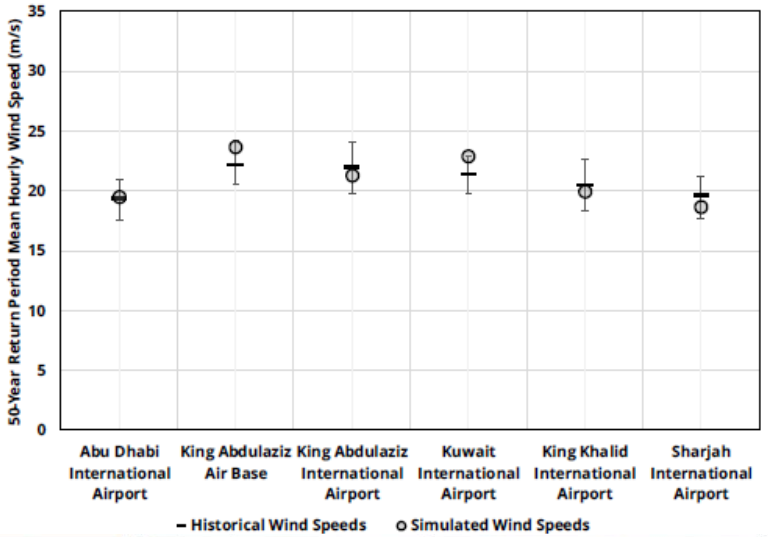


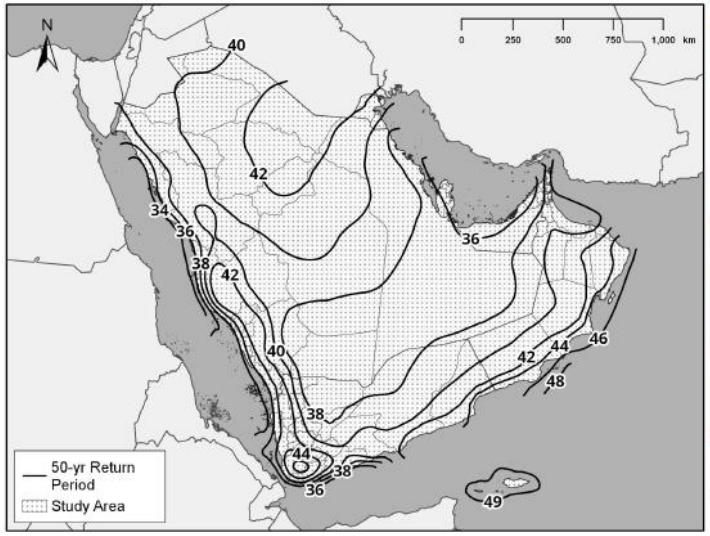
Success Case of Wind Parametrization at Desert Locations under low Data Availability (Arabic Peninsula)

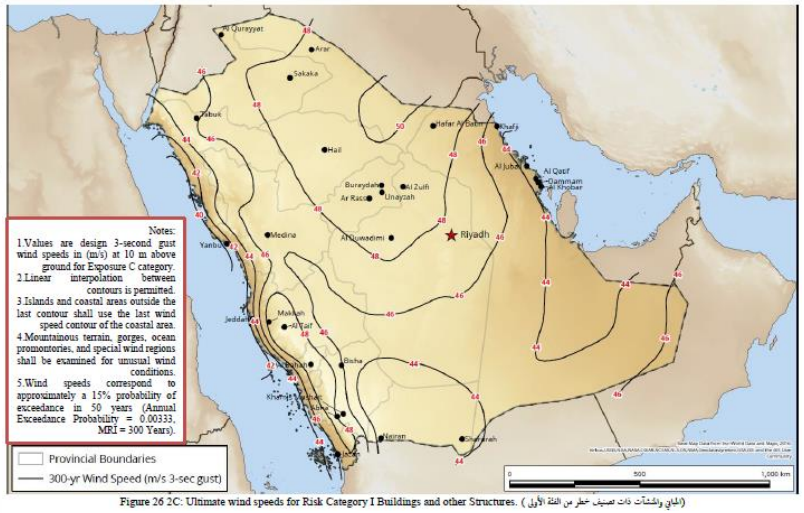
RWDI was retained by Gulf Cooperation Council Standardization Organization (GSO) to provide **contoured values for design wind speeds** and climate zones for the GSO member states (Saudi Arabia, United Arab Emirates, Kuwait, Bahrain, Oman and Yemen) consistent with the 2015 International Building Code (IBC) and International Energy Conservation Code.

This work was conducted based upon data obtained from **long-term meteorological stations in the region and the 30-year WRF re-analysis dataset**. The resulting maps will be included in the planned GCC Building Code, which will be a unified building code across the Arabian Peninsula



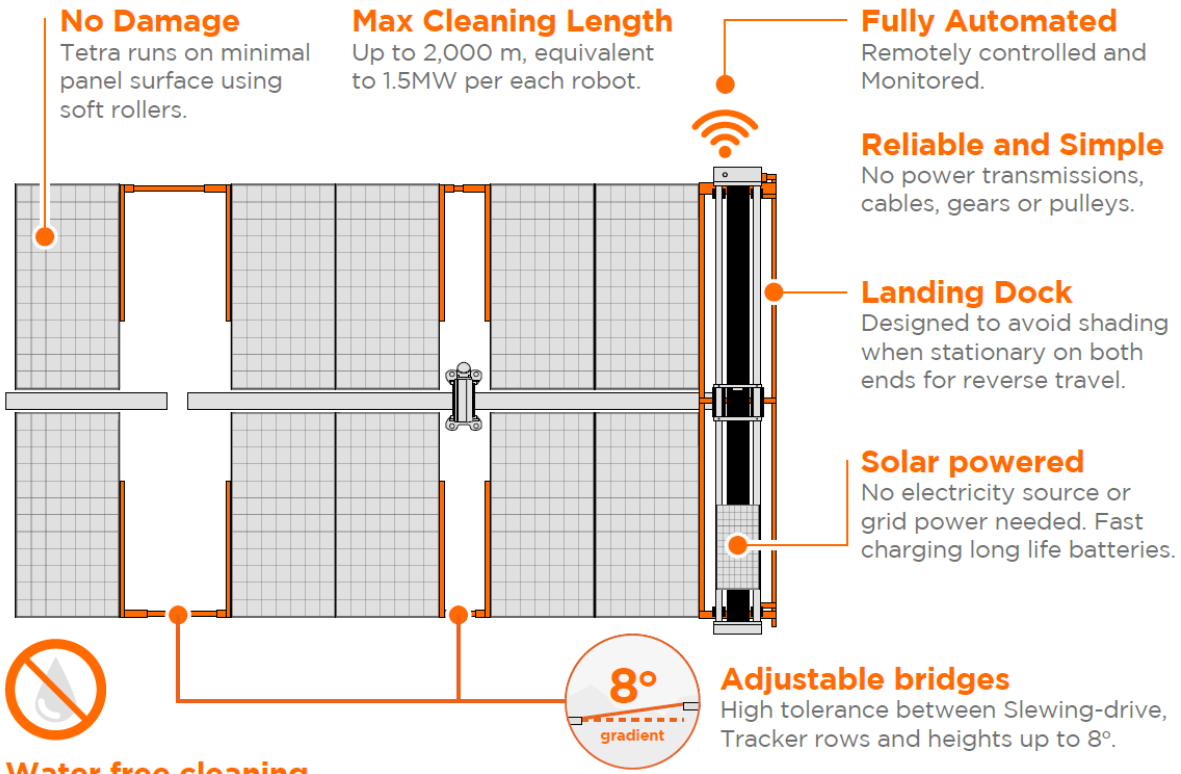






Source: Wind Hazard Assessment for Gulf Cooperation Council Standardization Organization member countries The 15th International Conference on Wind Engineering, Beijing, China; September 1-6, 2019 & SBC 301 – AR (2018)

5. Automated Cleaning integration, minimizing its CAPEX



No Damage
Tetra runs on minimal panel surface using soft rollers.

Max Cleaning Length
Up to 2,000 m, equivalent to 1.5MW per each robot.

Fully Automated
Remotely controlled and Monitored.

Reliable and Simple
No power transmissions, cables, gears or pulleys.

Landing Dock
Designed to avoid shading when stationary on both ends for reverse travel.

Solar powered
No electricity source or grid power needed. Fast charging long life batteries.

Adjustable bridges
High tolerance between Slewing-drive, Tracker rows and heights up to 8º.

Water free cleaning
No need for water infrastructure and water supply.

Real time analytics
Connectivity to weather real time and forecasted data ensuring cleaning performed in optimal time.

Key focus from tracker perspective:

- Allowing for **wide tolerances** of design
- **Minimising cost** of integration elements: dock stations, bridges and reverse stations
- Ensuring reliable communication and safe cleaning to **reduce OPEX**
- **Minimising the number of robots per MWp** by:
  - Avoiding gaps or interferences that robots could not undertake
  - Optimising layout to maximise number of trackers cleaned by a single robot

Wrap-Up

1. Bifacial PV trackers as key support of PV plant and bifacial gain booster
2. Desert Albedo provides 9-13% bifacial gain without additional maintenance
3. Atmospheric Corrosion requires determination to minimize corrosion risks
4. Wind Definition extremely important to obtain safe and cost-effective design
5. Automated Cleaning key role of integration to minimize both CAPEX and OPEX

HEADQUARTERS
Gabriel Campillo s/n
Pol. Ind. La Serreta
30500 Molina de Segura
Murcia, Spain
+34 968 603 153
+34 968 603 246
info@soltec.com

UNITED STATES
5800 Las Positas Rd
Livermore, CA 94551
+1 510 440 9200
usa@soltec.com

MADRID
Núñez de Balboa 33
28001 Madrid, Spain
+34 91 449 72 03
emea@soltec.com

SCANDINAVIA
Walgerholm 7
3500 Værløse, Denmark
+45 20 43 01 50
scandinavia@soltec.com

EGYPT
egypt@soltec.com

ITALY
italia@soltec.com

MEXICO
Jaime Balmes 11, Plaza Polanco
Torre B, Piso 6, Oficina B2
Colonia Los Morales
Delegación Miguel Hidalgo
Ciudad de México 11510
+52 1 55 5557 3144
mexico@soltec.com

BRAZIL
Dr. Barreto 483
Loteamento Jardim Aeroporto
Quadra 01, Lote 09
Bairro Pitangueiras
Lauro de Freitas-BA
CEP 42701-310
+55 071 3026 4900
brasil@soltec.com

CHILE
Rosario Norte 615, Oficina 1503
Las Condes, Santiago 7561211
+56 2 2573 8559
chile@soltec.com

PERU
República de Panamá 3576
Oficina 1101
San Isidro, Lima
+51 1422 7279
peru@soltec.com

ARGENTINA
Calle Buenos Aires 105, 2do.
Entre piso. Oficina A
Salta, Provincia de Salta
+54 911 48891476
argentina@soltec.com

INDIA
303, 3rd Floor, Tower 1
DLF Corporate Park
DLF Phase-3, Gurugram
Haryana 122002
+91 124 4568202
india@soltec.com

CHINA
Room 606, 1118 Nong Pudong
South Road, Pudong New
District, Shanghai
+86 21 66285799
china@soltec.com

AUSTRALIA
Level 32
1 Market Street
NSW, 2000
+61 (2) 9275 8888
australia@soltec.com

ISRAEL
israel@soltec.com

Soltec