HORIZONTAL SINGLE AXIS TRACKER IN WEATHERING STEEL, A SOLUTION WITH A LOW IMPACT ON THE LCOE AND LCA INDEX

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This paper describes the research activity carried out in the framework of a European project H2020, GOPV (***G**lobal **O**ptimization of integrated **P**hoto**V**oltaic system for low electricity cost*).
The research activity performed by **Convert – Valmont** inside the GOPV project has been focused to improve the existing know-how and to generate new one in the design of Horizontal Single Axis Tracker, for utility-scale PV plant optimized in terms of both Levelized Cost of Energy (LCOE) and Life Cycle Assessment (LCA) parameters.

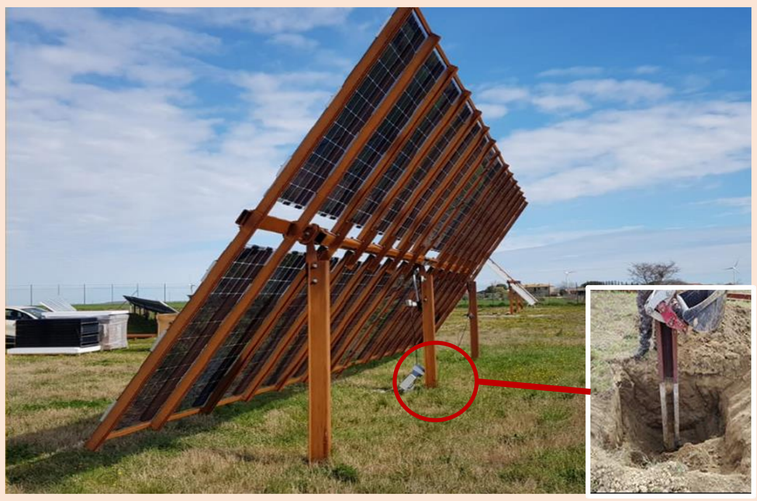
Approach & Activites

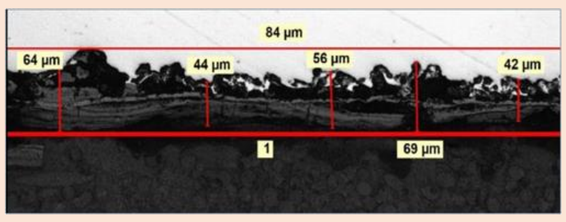
Corrosion Resistance Steel/ Coatings

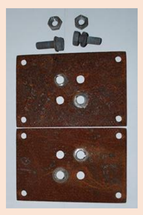
Encourage the use of Weathering Steel in the fabrication of tracker, as a cheaper steel-coating solution in aggressive corrosive environment, both for air and soil conditions. Solution with a lower environment impact.
Improvement of the know-how about the corrosion behavior of W. S. in aggressive environment has been achieved through an out-door long term corrosion experimental test program on small specimens. Topics of study:

- Prediction and measurement of the corrosion rate of W. S. in air and soil;
- Mechanical connections and bolts and possible use of hot galvanized bolts;
- Connection between W. S. and HDG steel components;

The monitoring of a tracker exposed in the environment of Tuscania (Italy) allowed to collect knowledge about the transferability of data from laboratory to real structures.



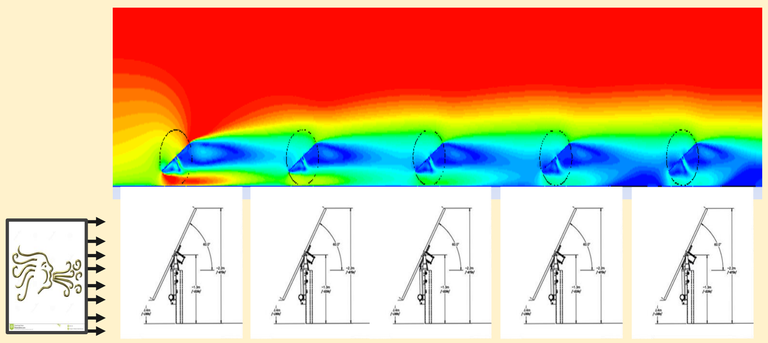




Wind static and dynamic loads

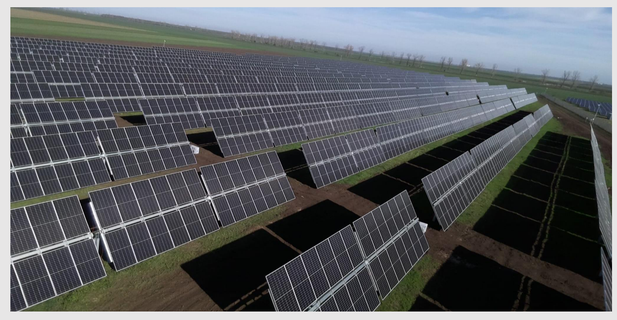
Perform an experimental evaluation of wind loads for Tracker design, in order to assure safe and economical approach, improving the existing standards (Eurocode 1-4 & ASCE 7-16). Achieving an optimization of amount of material used, with a lower environment impact.
Wind Tunnel tests has been performed at the Polytechnic of Milan (POLIMI), together with numerical CFD analysis (ANSYS code).
Topics of study:

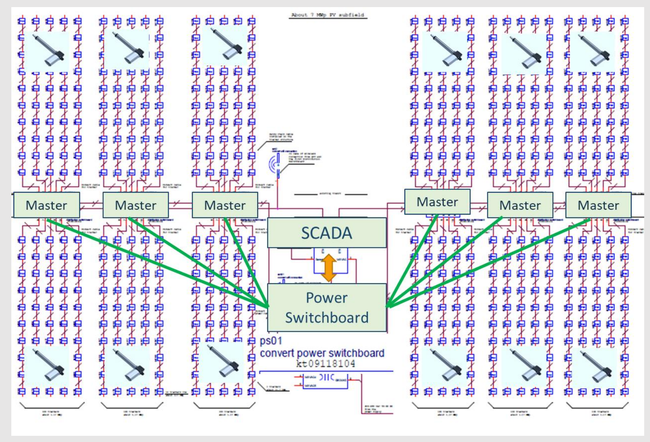
- Evaluation of wind pressure on single tracker vs wind speed (wind coefficients), for different tilting angle of tracker.
- Influence of the tracker position within the field layout in terms of wind coefficients.
- Definition of wind conditions/tilting angle that can lead the instability of tracker: Static Torsional instability (Divergence) and Dynamic Torsional Instability (Flutter/Galloping).



Control & Powering Systems

Development of a new Wireless Control & Powering Systems integrated to new generation of monitoring SCADA A.I., in order to reduce cables and time for commissioning of PV plant and, at the same time, assure a high reliability of the monitoring combined with a lower environmental impact. This system referred to as “Control & Power 100M” is based on a "Master - Slave" configuration, where a single “Master” board, controls and power a series of “Slave” boards of very reduced dimensions that are positioned inside each actuator. The system can connect up to 100 actuators. In parallel, a full new Centralized Tracker Wireless Control System, has been developed: the SCADA A.I.
All developed components have been tested in agreement with the EN-IEC-62817, in particular all components including actuators have been tested within -30°C/+85°C in a climatic chamber





Results & Conclusion

Weathering Steel as a lower cost steel/coating:

- Confirmed for class of environment C1, C2, C3 (+25 years), through a correct assessment of over-thickness at the design phase.
- Allows to eliminate the HDG coating with a reduction of tracker cost of about 10% - 20% (with a reduction of LCOE)
- CO_2 emissions reduction related to the tracker fabrication process.

The total steel weight optimization, thanks to WTT and CFD, leads to a saving that can be estimated as 10-20% for the whole PV utility plant.
Assuming a GOPv geometry Tracker (2P), wind speed at 40 m/s has been estimated as the threshold: for aeroelastic instability, considering static torsional instability, divergence and galloping event

New Wireless Control & Powering Systems integrated to SCADA A.I.:
reduction of length/weight of cables and trenches of 10%÷60% (depending also the dimension/layout of plant). In parallel also time for commissioning can be reduced; no batteries are required in the field device.
A higher reliability in the monitoring is possible using the new SCADA A.I., integrated also with new PV plant configuration, as AgroPV.

Application of GOPV know-how in the next tracker system scenario: AGROPV

Results obtained within the GOPV research project has been used to develop the first Convert – Valmont horizontal axis tracker for AgroPV for a citrus tree, in collaboration with ***EF Solare Italia*** and ***Le Greenhouse***.

- Base material W.S.: to reduce the have a low visual impact (brown structure)
- “Control & Power 100M”: reducing the number of cables in an area where the presence of means and men will be common
- SCADA A.I.: to assure the monitoring and control also of agro parameters.
- New Wind Loads and Aerodynamic coefficients: to optimize the weight and reliability of a “slim” structure, height > 3 meters