LCOE REDUCTION APPROACHES FOR BIFACIAL PV PLANTS

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A) Lighter Tracking Structures with 1-axis tracking for bifacial PV modules

METHODOLOGY

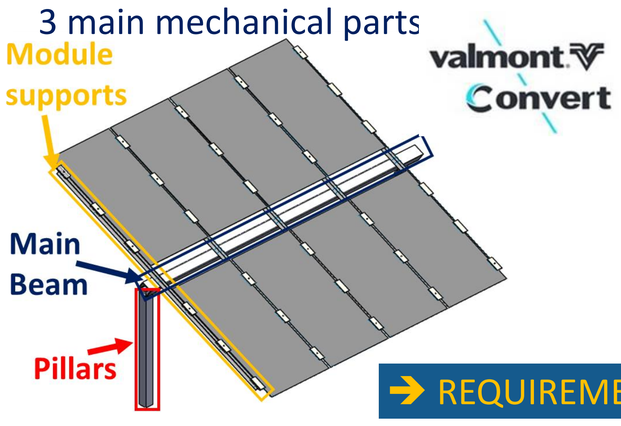
1) MATERIAL DEFINITION + CHARACTERIZATION

- Pultruded Glass Fiber Reinforced Polymer (GFRP)
- **Fiber volume fraction: 70%**
- 4 mats along the thickness to improve transversal properties.
- Temperature resistant & UV protection (outer veil)

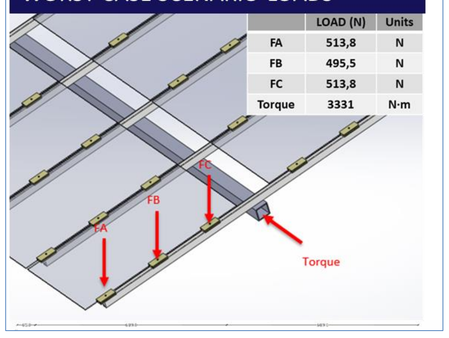
➔ MATERIAL PROPERTIES: Tested

2) DESIGN AND DEVELOPMENT OF GOPV TRACKER

- 2 modules portrait configuration
- 3 main mechanical parts



WORST CASE SCENARIO LOADS

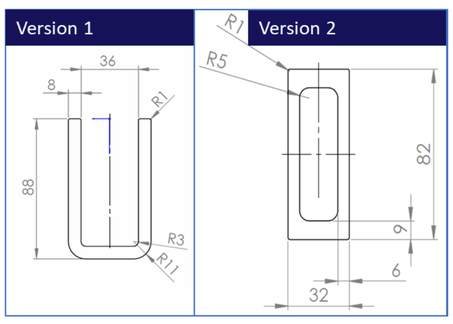


	LOAD (N)	Units
FA	513,8	N
FB	495,5	N
FC	513,8	N
Torque	3331	N·m

➔ REQUIREMENTS : Loads + Deformations

3) GFRP PARTS: DEFINITION AND DESIGN

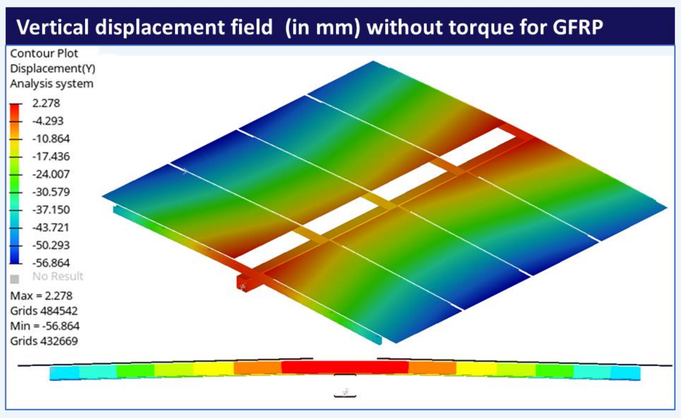
- Selected profile: U; O.
- Dimensions to find equivalent resistance: inertia-Young modulus to WS design
- Validated with simulations (FEM) (iterative process)



RESULTS

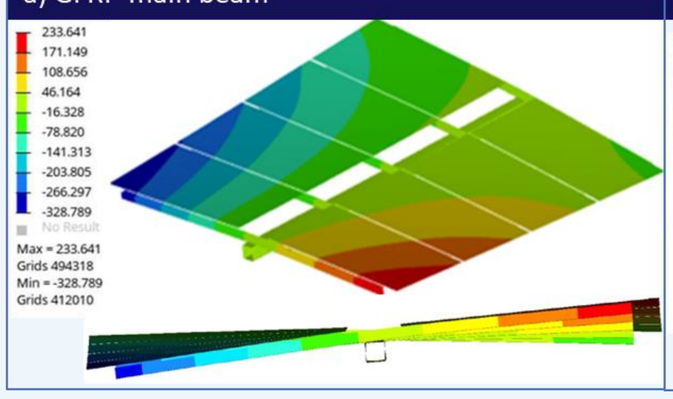
Property	Description	Units	Steel	Glass	GFRP pristine	
					x	y
E_i	Elastic modulus	GPa	210	60	30.0	13.4
ν_{xy}	Poisson's ration xy	-	0,33	0,33	0.2	
G_{xy}	Shear modulus xy	GPa	--	--	3.51	
$\sigma_{u,i}$	Ultimate strength	MPa	--	--	385.4	45.8
S_{xy}	Shear strength	MPa	--	--	63.35	

Vertical displacement field (in mm) without torque for GFRP

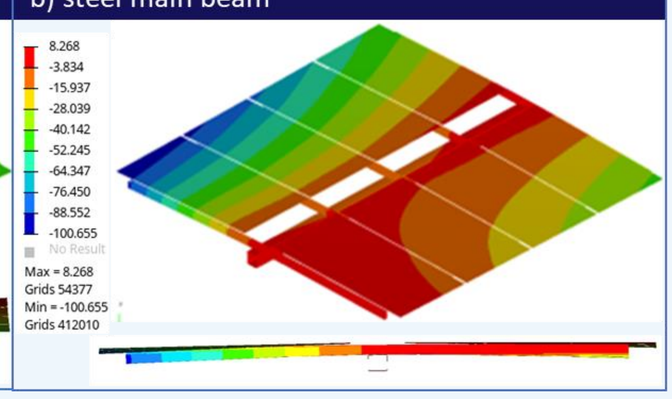


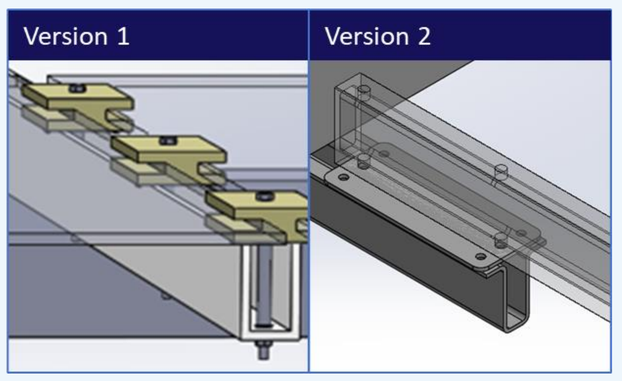
Vertical displacement field (in mm) with Torque

a) GFRP main beam



b) steel main beam



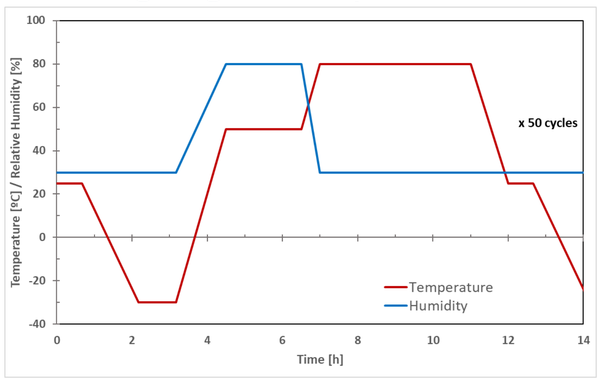


- Main beam of WS to increase rigidity
- Development of module support parts with GFRP in a lighter hybrid structure.
- New profile (version 2) due to punctual efforts while mounting.

B) Advanced tests (indoor/outdoor) of PV components and parts (lifetime ≥ 35 years)

1) INDOOR TESTS

- Materials aged using standard test cycle for automotive polymeric parts.
- Mechanical properties after accelerated ageing tests did not change significantly.



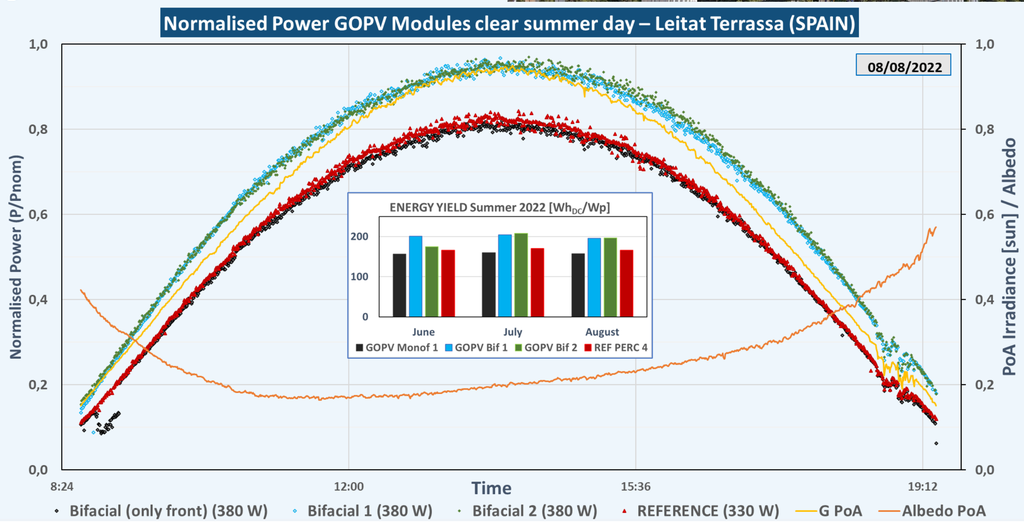
2) OUTDOOR TESTS

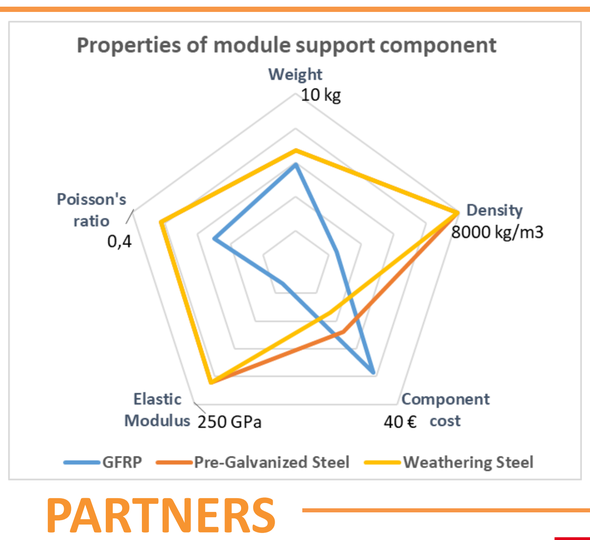
- Plant parts installed on site, tested in Tuscania for more than 1 year.

Bifacial Modules Monitoring

- Higher Yield of bifacial GOPV modules in several climates/ regions.

Normalised Power GOPV Modules clear summer day – Leitat Terrassa (SPAIN)





CONCLUSIONS

- GFRP can be applied as low weight material (5% of weight reduction per module support) for their use in 1-axis PV trackers. Tested successfully in bifacial PV trackers in Tuscania, with lower OPEX costs due to their lower weight.
- Material costs are high due to the production and mould required to manufacture the parts: economies of scale are needed to drive more competitive prices.
- Optimization to improve GFRP properties or novel tunned materials may be applied using this approach for hybrid trackers to achieve a competitive performance-cost relationship, lower material consumption and reducing weight.
- Future work may be directed to relevant applications in which corrosive environments are found for metallic structures, like coastal areas or floating PV.

PARTNERS

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