



Laborelec
RESEARCH & INNOVATION



AGRIVOLTAICS
WORLD CONFERENCE
Delhi, 23-Oct 2026

Next-Generation
Solar Technologies
for Agrivoltaics





Lab Crigen
RESEARCH & INNOVATION

Lab Cylergie
RESEARCH & INNOVATION

Lab Singapore
RESEARCH & INNOVATION

Factory Asia Pacific
RESEARCH & INNOVATION

New Ventures
RESEARCH & INNOVATION

Laborelec

RESEARCH & INNOVATION



**El Águila PV Test Center:
Northern Chile**



**Laborelec
Riyadh, Dubai,
France,
Netherlands**



ENGIE in INDIA

From 2.4 MW humble start in 2014 to a **“PEOPLE POWERED”** ORGANISATION TODAY

Highlights



SET Certified from Bureau Veritas



Recognized Best Org for Women



34 yrs. avg age, 27% Females



Renewable Indl. platform supporting many countries from India



Launched Global Maintenance Services, FPDC already supporting AMEA

ENGIEUrja.ai

India's first open innovation platform



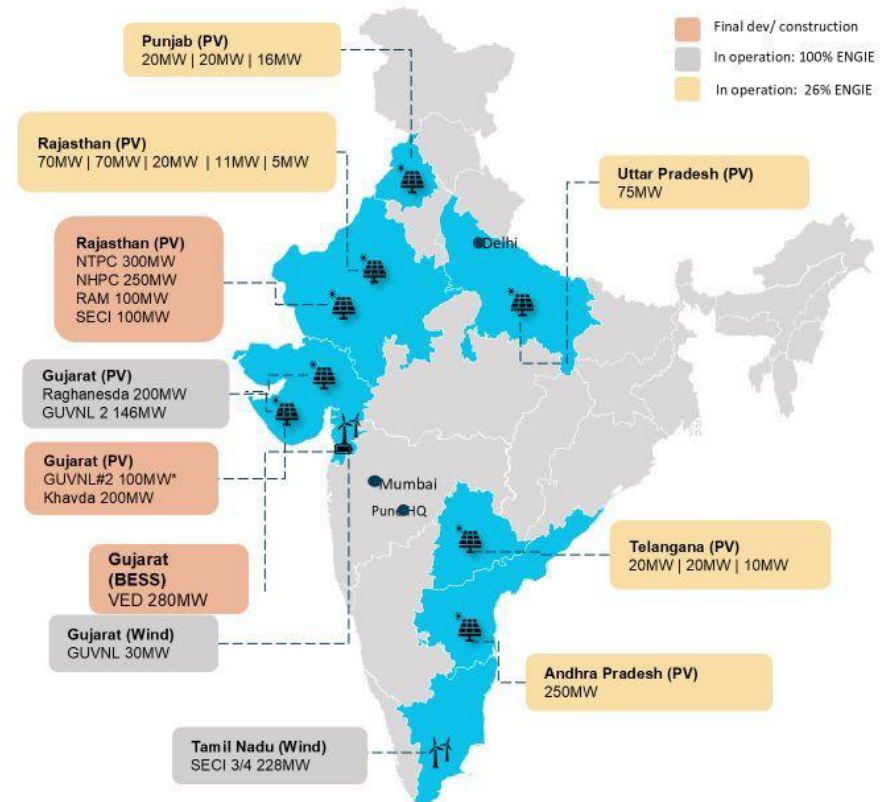
Labelled as Indo French Year of Innovation Event



Strong stakeholder & community engagement



Current operating footprint



#Next-Generation Agrivoltaics

How long is *a generation*?

A generation is the average time between parents and their offspring—
or the time for a new version to replace an existing one.

Tortoise



80–150
years

Human



20–30
years

Cat



4–7
years

Technology

Automobile



5–7
years

Mobile phone



1–2
years

Frog



1–2
years

Chicken



5–8
months

Mosquito



1–2
weeks

Bacteria
(e.g. E. coli)



20–30
minutes

"Gen 0" The visionaries (1981)



Neuer Vorschlag der Fraunhofer-Gesellschaft

Kartoffeln **unter** dem Kollektor

Solarfarmen und Landwirtschaft müssen nicht unbedingt in einem Gegensatz zueinander stehen. Beide Bereiche lassen sich vielmehr vortrefflich miteinander verbinden. Daß das funktioniert, zeigen beispielsweise entsprechende Versuche in Saudi-Arabien.

Neu ist jetzt ein Vorschlag für eine besonders günstige Anordnung für Solarenergieanlagen in Verbindung mit der landwirtschaftlichen Nutzung. Dieser Vorschlag wurde von Prof. Adolf Goetzberger und Armin Zastrow vom Institut für Solare Energiesysteme in Freiburg erarbeitet.

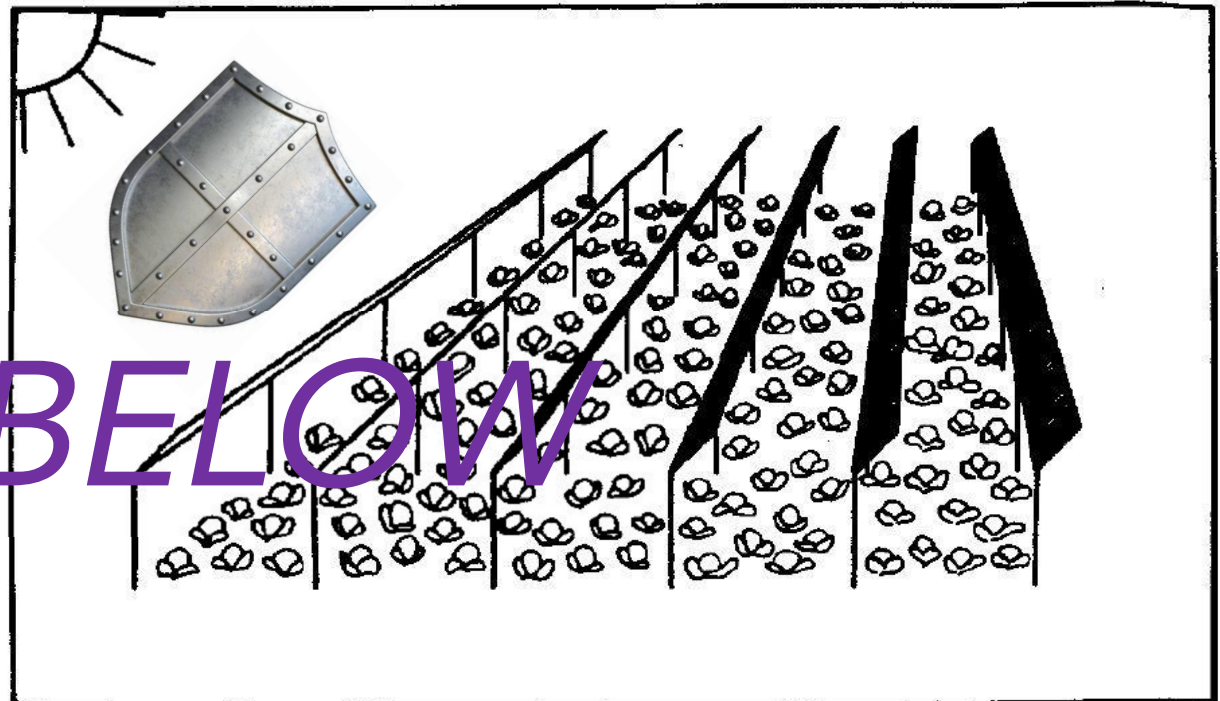


ABB. 1 SKIZZE EINES KOLLEKTORFELDES mit angehobenen Kollektoren

"Gen 1" - The pioneers (late 2000's)

Montpellier, FRANCE
"L'Agrivoltaïsme"



Chiba, JAPAN
ソーラーシェアリング
("Solar Sharing")

Established 'Solar Sharing Promotion group'
End of June 2011



#BELOW

"Gen 1" First commercial *PV Greenhouses*: ~2011

SOLAR GREENHOUSES

ITALY

4.3 MW



AGRIENERGIA, SOLAR
GREENHOUSES
2011

PV layer:
TOO DENSE

#BELOW

#Subsidized

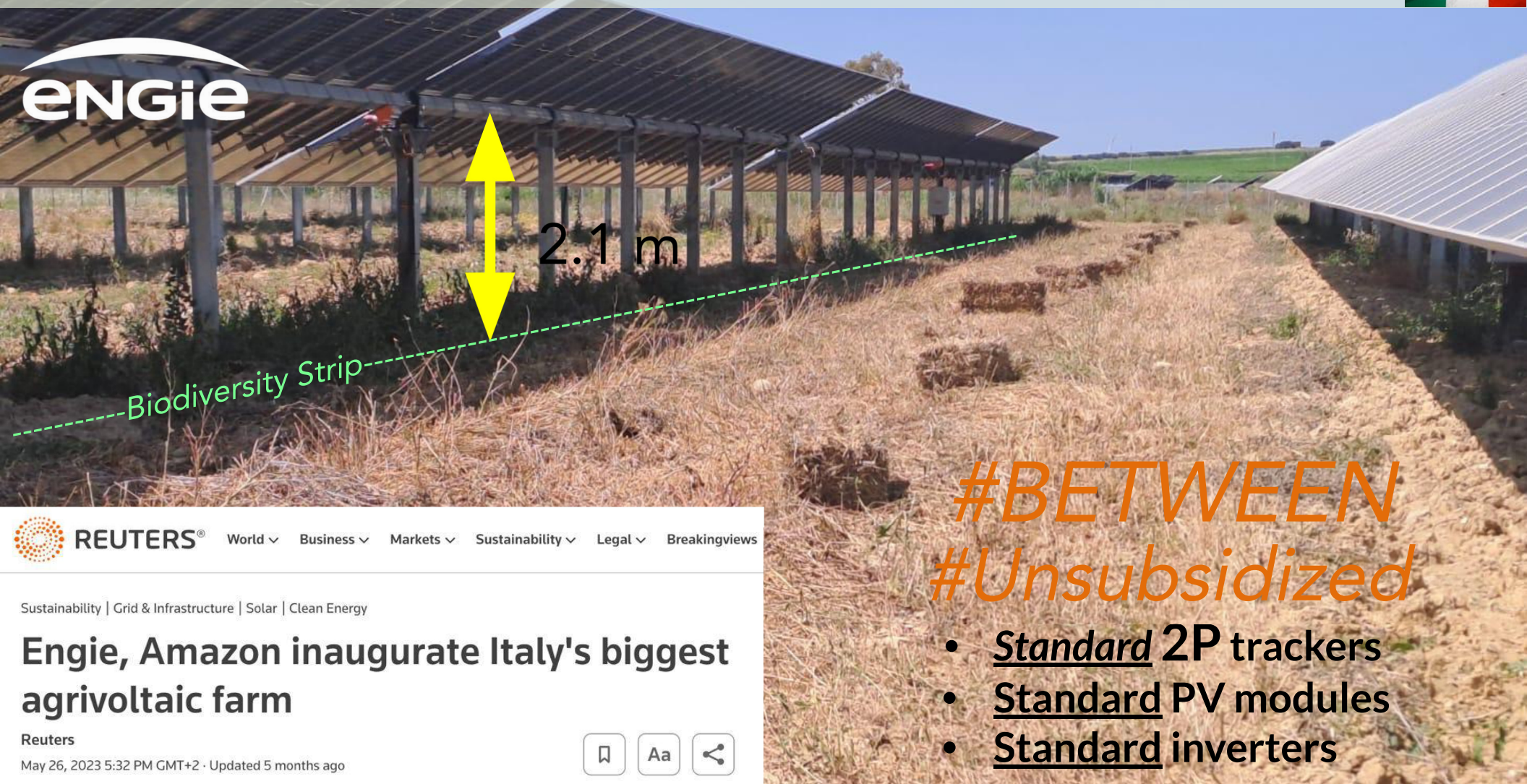
(not an ENGIE project)



"Gen 1": 🧛 The *Dark Ages* of Agri-PV in Europe (early-mid 2010's)



"Gen 2": Utility-scale Interspace Agri-PV



*#BETWEEN
#Unsubsidized*

- Standard 2P trackers
- Standard PV modules
- Standard inverters

 **REUTERS®** World ▾ Business ▾ Markets ▾ Sustainability ▾ Legal ▾ Breakingviews

Sustainability | Grid & Infrastructure | Solar | Clean Energy

Engie, Amazon inaugurate Italy's biggest agrivoltaic farm

Reuters

May 26, 2023 5:32 PM GMT+2 · Updated 5 months ago

"Gen 2": Utility-scale Interspace Agri-PV



"Gen 2": Utility-scale Interspace Agri-PV



#BETWEEN

Hay PV in Texas, US, 2025

(not an ENGIE project)

"Gen 2": Utility-scale Interspace Agri-PV

Inter-row Aromatic herb trials at Mazara

#BETWEEN



"Gen 2.5": Utility-scale Interspace (Vertical Bifacial) APV



#BETWEEN



Earth's Recorded Temperature Range

From the coldest place ever recorded on Earth to the hottest

-89 °C

**Coldest ever recorded
on Earth**

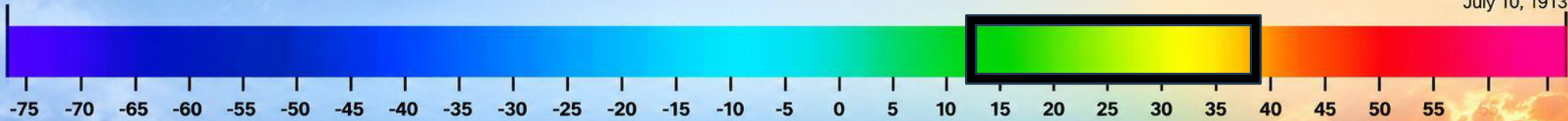
Vostok, Antarctica
July 21, 1983

+56 °C

**Hottest ever recorded
on Earth**

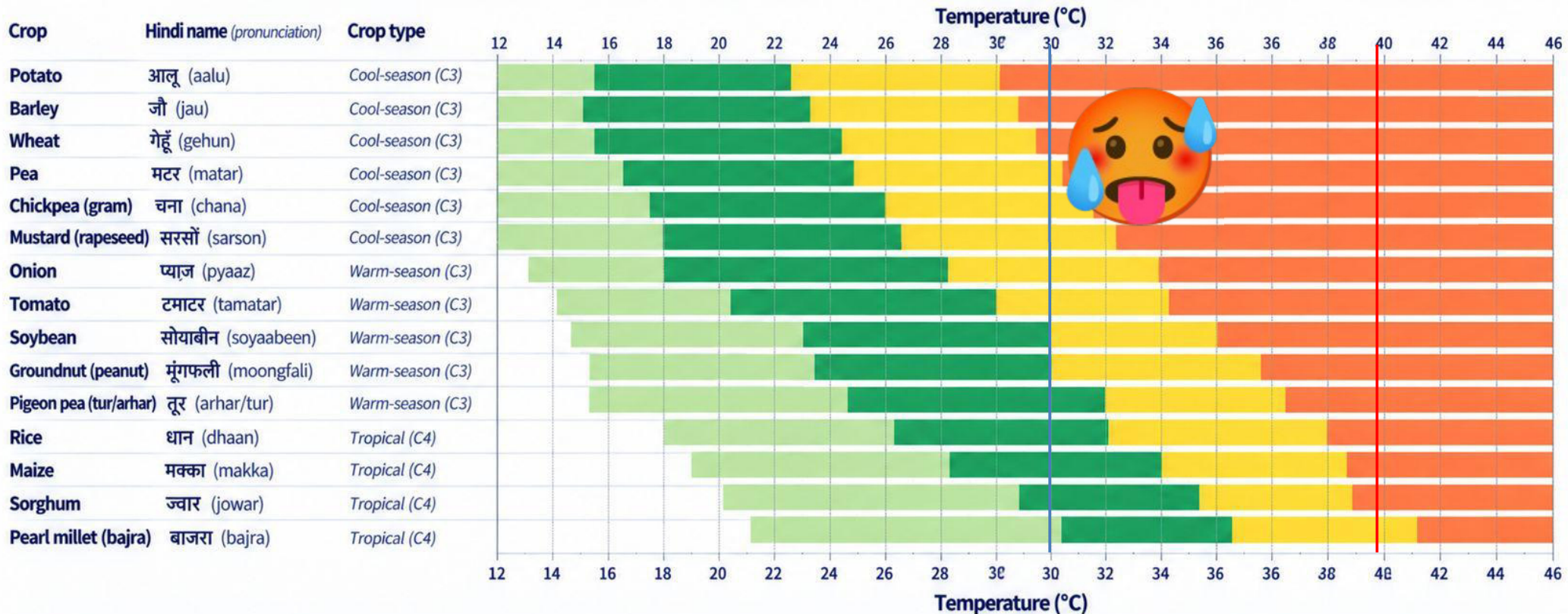
Furnace Creek
Death Valley, USA
July 10, 1913

Crop comfort zone



Temperature Response Zones for 15 Major Crops in India

Approximate ranges for growth and yield (varies by variety, growth stage, water status and duration of exposure)



Notes:

1. Ranges are approximate and represent typical temperature response for growth and yield, synthesized from multiple sources (e.g. FAO, ICAR and peer-reviewed studies).
2. Thresholds vary by variety, growth stage (vegetative, flowering, grain/tuber filling), water and nutrient status, day/night temperature and duration of exposure.
3. Temperatures refer to air or canopy/leaf temperature (literature uses both).
4. "Dangerous heat stress" indicates a high risk of severe physiological or reproductive damage and large yield losses, not necessarily plant death. All crops are assumed to be within their normal/ growing season and with adequate water.



Genetic Diversity in Major Global Crops

Estimated number of distinct cultivars/hybrids available and broader genetic diversity (genebank scale)



#	Crop	Icon	Cultivars / Hybrids obtainable worldwide (estimate)	Broader genetic diversity (genebank scale)	#	Crop	Icon	Cultivars / Hybrids obtainable worldwide (estimate)	Broader genetic diversity (genebank scale)
1	Rice		5,000 – 15,000+	~130,000 accessions (IRRI)	14	Groundnut (Peanut)		1,000 – 3,000	Tens of thousands
2	Wheat		5,000 – 10,000+	>800,000 accessions globally	15	Cotton		2,000 – 5,000+	Tens of thousands
3	Maize (Corn)		10,000 – 30,000+	28,000 accessions (CIMMYT)	16	Common bean		3,000 – 10,000+	Tens of thousands
4	Soybean		5,000 – 15,000+	Tens of thousands	17	Tomato		10,000 – 20,000+	Many thousands of accessions
5	Potato		2,000 – 5,000	Tens of thousands	18	Onion		2,000 – 5,000	Thousands
6	Cassava		1,000 – 3,000	Tens of thousands	19	Pepper (Chilli)		5,000 – 10,000+	Tens of thousands
7	Sweet potato		1,000 – 3,000	Tens of thousands	20	Cucumber		2,000 – 5,000	Thousands
8	Barley		3,000 – 7,000	Hundreds of thousands	21	Watermelon		1,000 – 3,000	Thousands
9	Sorghum		2,000 – 5,000	Tens of thousands	22	Banana (Plantain)		500 – 1,500	Thousands
10	Millet		1,000 – 3,000	Tens of thousands	23	Apple		5,000 – 10,000+	Thousands
11	Sugarcane		1,000 – 3,000	Several thousand+	24	Grape		5,000 – 10,000+	Thousands
12	Rapeseed (Canola)		2,000 – 5,000	Tens of thousands	25	Coffee		500 – 1,500	Many thousands of accessions
13	Sunflower		2,000 – 5,000	Tens of thousands					

#Breed
#Robustify
#Resilience



Plant species, genetic varieties,
soil, inputs, cultivation strategies.



[Home](#) [News](#) [Sport](#) [Business](#) [Technology](#) [Health](#) [Culture](#) [Arts](#) [Travel](#) [Earth](#) [Audio](#) [Video](#) [Live](#)

Solar resource, seasonality,
temperature, humidity, wind,
precipitation.

PV design: equipment selection,
array density, height, pitch,
tracking strategy.

Heatwaves spur efforts to find drought-resistant crops

24 August 2026

Share



Save



 Add as preferred on Google

Alex James

in Edmond, Shropshire

Biologist taking on climate change with new maize

25 September 2026

Share



Save



 Add as preferred on Google

Lewis Adams

Essex

#Breed
#Robustify
#Resilience



Crops

Plant species, genetic varieties,
soil, inputs, cultivation strategies.

#Forecast
#Foresee



Climate

Solar resource, seasonality,
temperature, humidity, wind,
precipitation.



Configuration

PV design: equipment selection,
array density, height, pitch,
tracking strategy.

#Below
#Between

The 5 C's of Agrivoltaic Success



Compatibility

Working with the realities of farming:
mechanized and manual ergonomics,
Economic Viability, Regulatory Compliance.



Collaboration

Aligning farmers, developers, lenders, off-takers,
operators, technicians, scientists, researchers,
communities.

#Smart Irrigation
#Dynamic Shade Management

Macdonald + NREL; ChatGPT

"Gen 1"
Cultivating BELOW
Subsidized
High-density
Small-scale
Elevated arrays



"Gen 2"
Cultivating BETWEEN
Unsubsidized
Medium-density
Utility-scale
Conventional low Trackers



Semi-Elevated Single-Axis Trackers

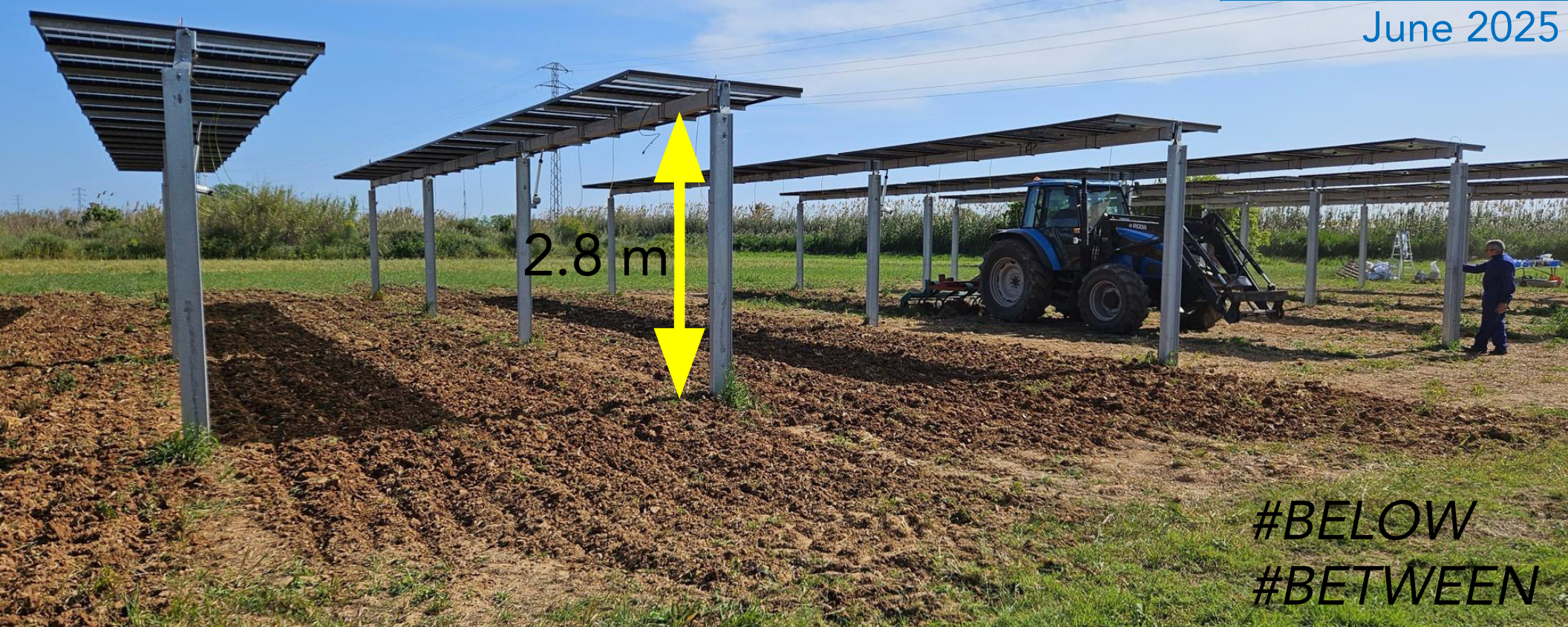
Polytech University of Catalonia

Laborelec
RESEARCH & INNOVATION



UNIVERSITAT POLITÈCNICA
DE CATALUNYA
BARCELONATECH

June 2025



Barcelona: 1650 kWh/m²/yr



Parc Agrari del Baix Llobregat

Just beside the BCN airport, 2km from the coast

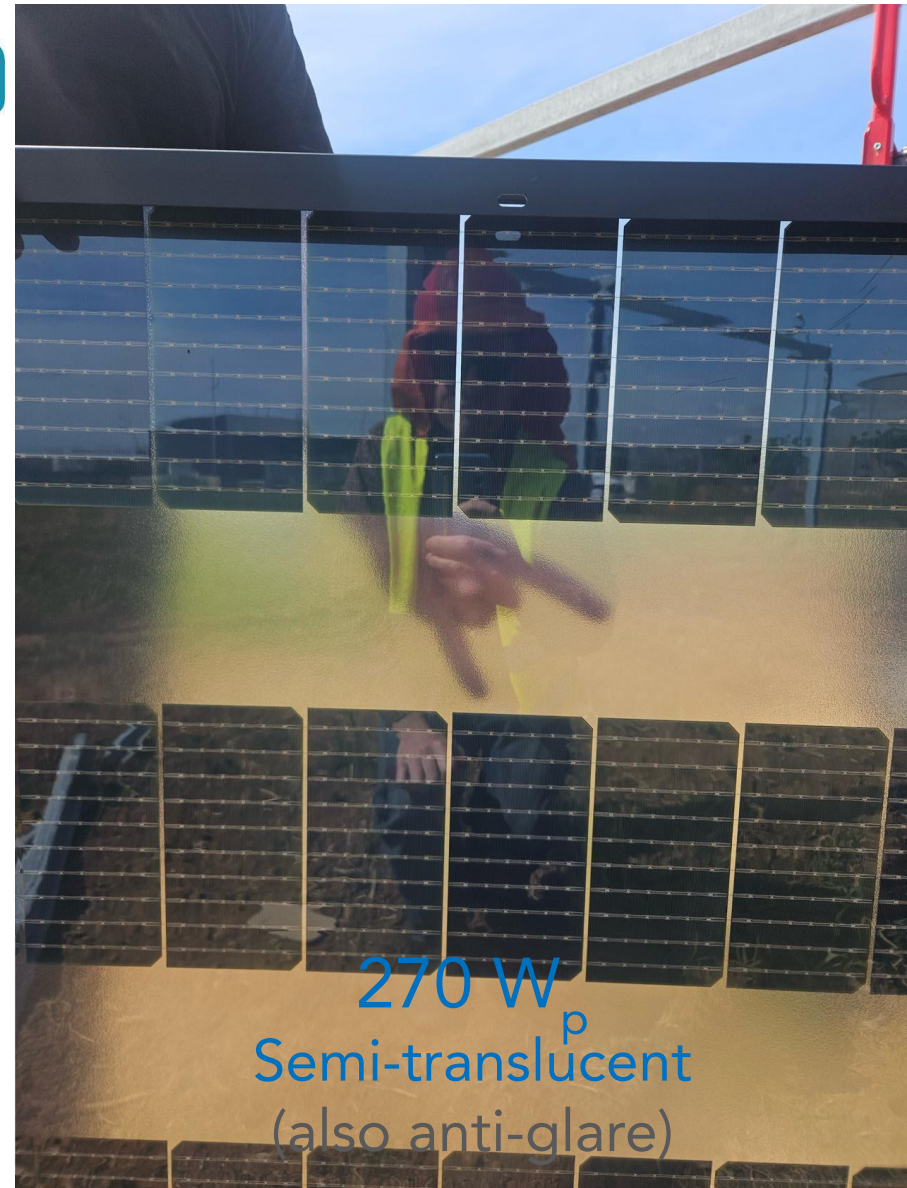


Triple comparison :

PV (standard) 🌱 **versus** **PV (translucent)** 🌱 **versus** **Open field** 🌱



aleo









Measurements during cultivation



Measurements at harvest and postharvest

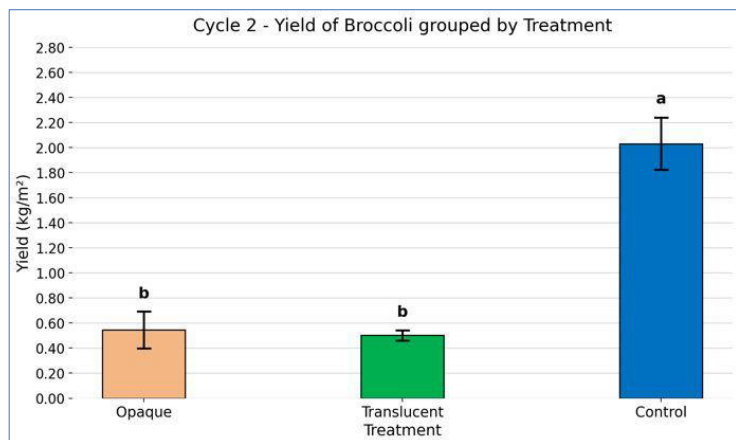
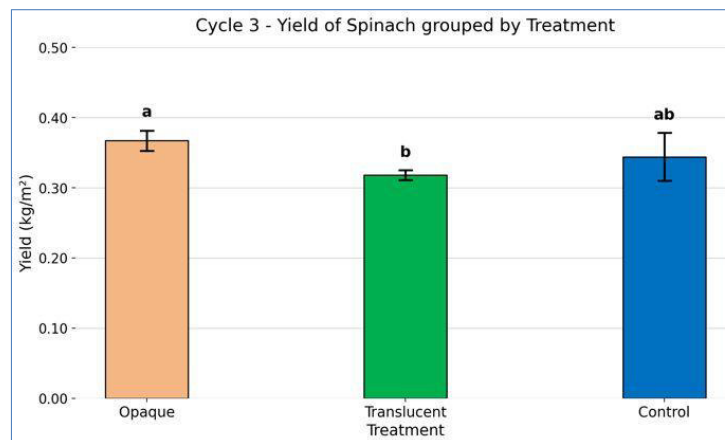
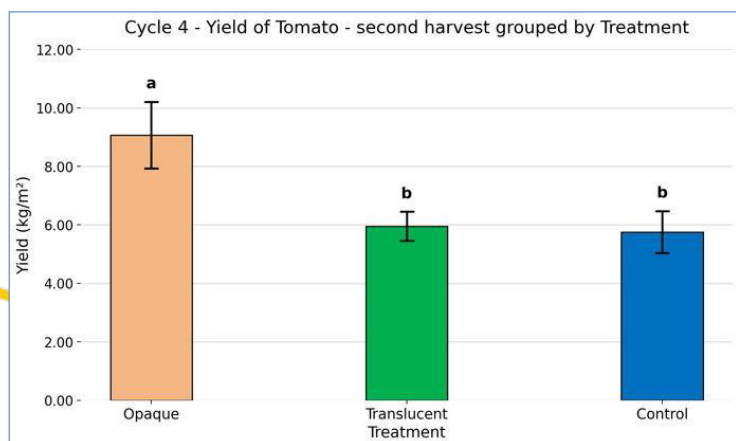
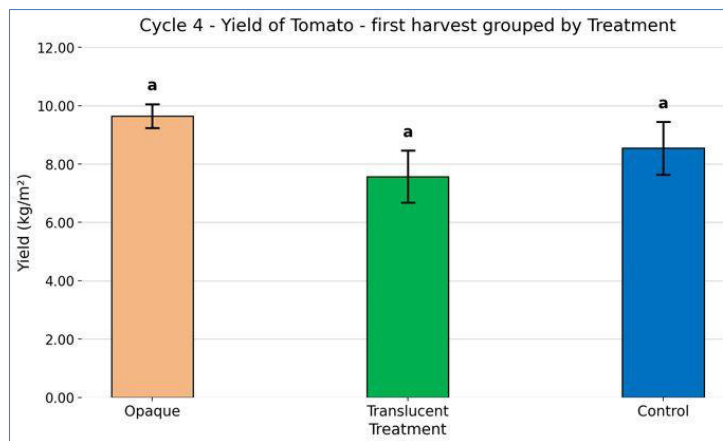




Production preliminary results

BROCCOLI, SPINACH and TOMATO

CYCLES	
CYCLE 1	June-July 2025
CYCLE 2	Sept.-Dec. 2025
CYCLE 3	Jan.-April 2026
CYCLE 4	April-Sept. 2026



NEXT STEPS

- Complete remaining postharvest quality measurements
- Conclude comprehensive data processing and analysis
- Cross-analyse and integrate crop agronomic data with microclimate environmental variables

#CollaborationConstellations #COMMUNITY

Disclaimer: No vegetables were damaged or wasted during these experiments.



"To do things right, first you need love, then technique". A. Gaudí.

(We may have both).



Photo credit: Espigoladors



#AST: Agrivoltaic Smart Tracking

Research article [Get rights and content ↗](#)

Optimized agrivoltaic tracking for nearly-full commodity crop and energy production

[E.K. Grubbs^{a b}](#)  , [S.M. Gruss^c](#), [V.Z. Schull^d](#), [M.J. Gosney^e](#), [M.V. Mickelbart^e](#), [S. Brouder^c](#), [M.W. Gitau^f](#), [P. Bermel^{a b}](#)  , [M.R. Tuinstra^c](#), [R. Agrawal^g](#)
[Show more](#) 

 Cite  Add to Mendeley  Share | [10.1016/j.rser.2023.114018 ↗](#)

Research article [Get rights and content ↗](#)

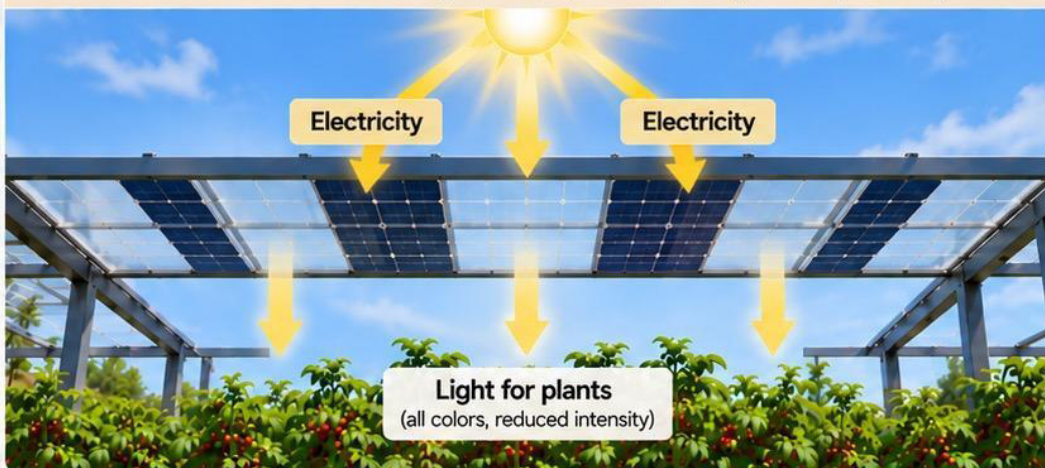
How does module tracking for agrivoltaics differ from standard photovoltaics? Food, energy, and technoeconomic implications

[Habeel Alam](#) , [Nauman Zafar Butt](#)   [Show more](#) 

 Cite  Add to Mendeley  Share | [10.1016/j.renene.2024.121151 ↗](#)

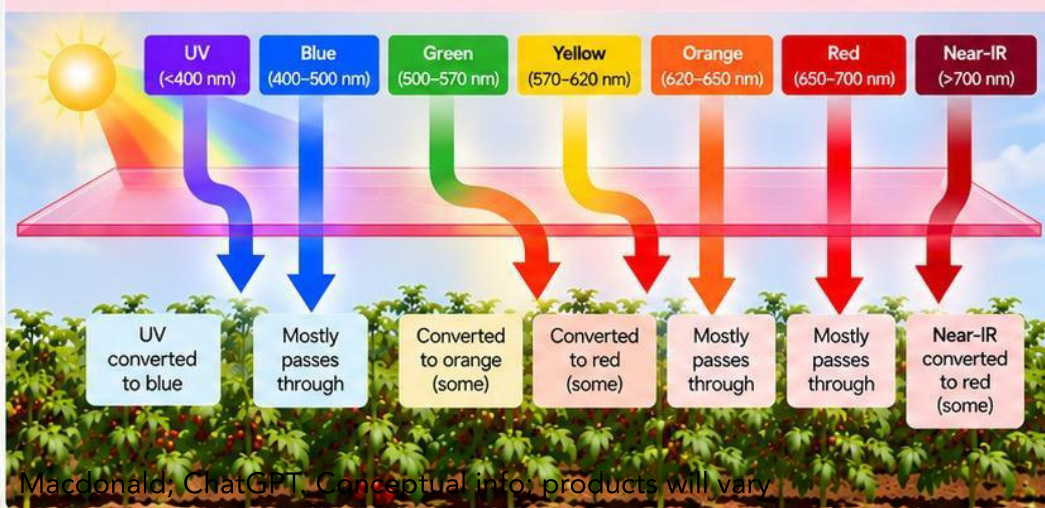
Semi-translucent PV

Lets a fraction of sunlight through (all colors) while generating electricity



Spectral conversion film

Converts UV and green-yellow to longer wavelengths (e.g. UV → blue, green/yellow → red/orange, near-IR → red)







#BELOW
#Subsidized

(not an ENGIE project)

250 MW elevated PV: 6m (!!!) over apple trees
Zhejiang, China June 2026



—

**Exciting opportunities ahead !!
Thanks for your attention !!**

James.macdonald@external.engie.co
JM@solarcrop.com ig= @solarcrop



☐ PUBLIC ☒ INTERNAL ☐ RESTRICTED ☐ CONFIDENTIAL