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ANALYSIS OF AGRIVOLTAICS FARMS IN THE NETHERLANDS

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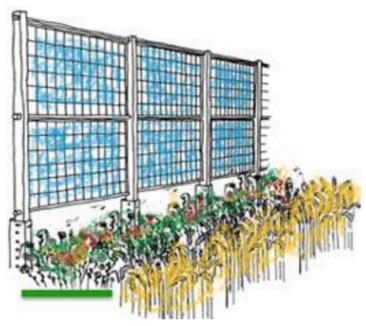
AIM

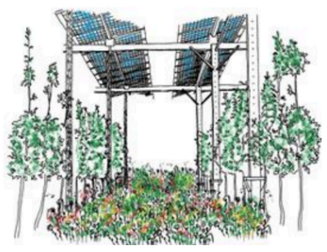
Agrivoltaics integrates photovoltaic systems with crop cultivation, enhancing land productivity.

What is the optimal AGRI-PV setup in the Netherlands, considering vertically mounted and single-axis tracking bifacial systems, to maximise the Land Equivalent Ratio (LER)?

Set- Up



Vertical Bi-facial system: 90° tilt, azimuth 90°



Single-Axis Tracker (SAT) Bifacial system: tilt up to 60°, azimuth 90°

PAR scenarios: 600, 700, 800 µmol photons $m^{-2}s^{-1}$ for low, medium and high crops, respectively.

Methodology

Data Collection → Gather meteorological, soil, and irradiation data; Input from interviews and literature review.

Agri-PV Modelling → Simulate a 50×50 m² farm with vertical & SAT bifacial panels, varying row spacings (using Python & QGIS for spatial modelling and solar calculations).

Yield & Shading Analysis → Calculate **PAR** distribution, shading losses, and electricity output.

LER Evaluation → Compute Land Equivalent Ratio for different crops and identify optimal configurations.

Results

- **Low irradiation crops** (e.g., lettuce, berries): Best under SAT at 5 m spacing, LER = 1.64; vertical systems peak at LER = 1.34.
- **Medium irradiation crops** (e.g., potatoes): Optimal at 6–7 m spacing, LER ≈ 1.24 for both setups.
- **High irradiation crops** (e.g., tomatoes): Feasible only >13 m spacing, LER ≈ 1.11–1.15; narrower spacing yields LER < 1 (inefficient).
- **Geospatial suitability**: Southern & coastal Netherlands - higher PV output, suitable soils, and favourable wind.

System comparison: SAT yields higher returns but is costlier & complex; vertical systems are simpler, cheaper, and maintain a stable LER.

Figure 1: LER vs. Row Spacing for Low-Demand Crops

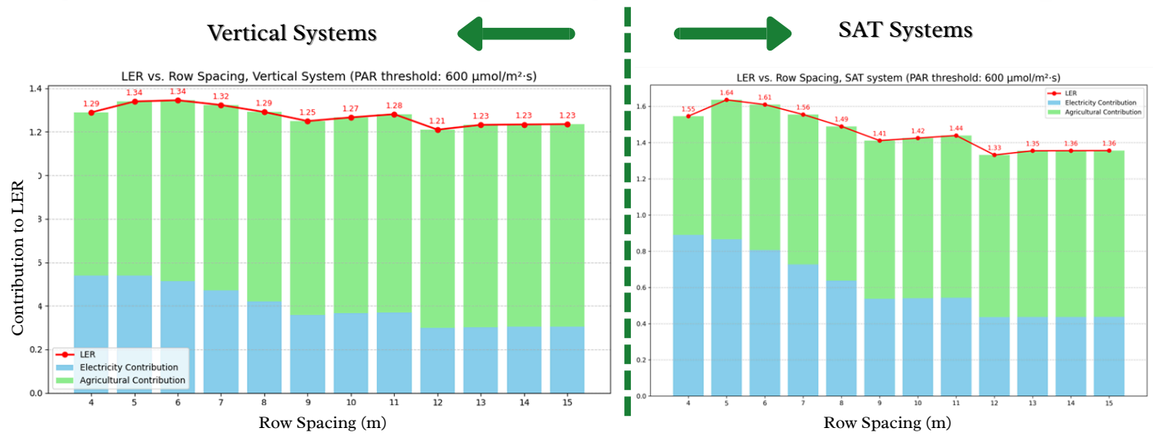
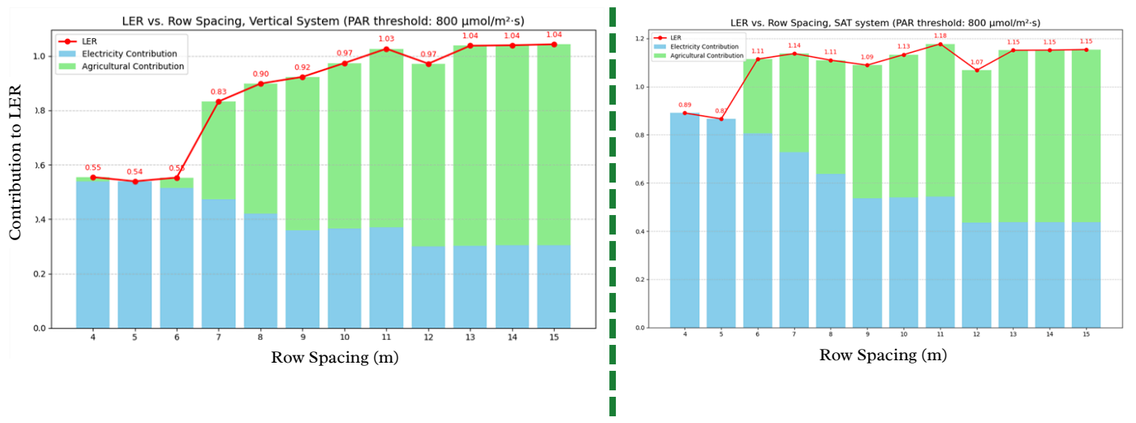


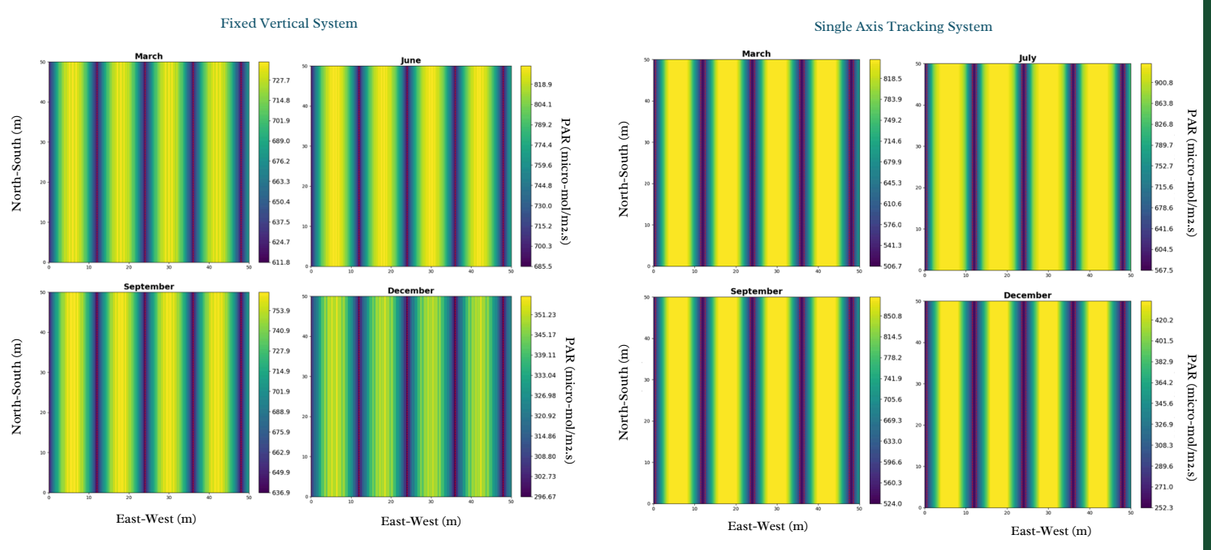
Figure 2: LER vs. Row Spacing for High-Demand Crops



Conclusion

- SAT systems outperform vertically mounted panels, especially for low to medium-demand crops.
- High-demand crops face feasibility limits in Agri-PV due to shading.
- Agri-PV is promising for Dutch agriculture, but economic, policy, and grid integration barriers remain.

Figure 3. PAR levels (12m spacing) across the year



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