Copernicus Climate Change Service (C3S) Energy Seminar

Climate Change

European Solar Power Indicators for the PECD

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Rodrigo Amaro e Silva
Yves-Marie Saint-Drenan

PROGRAMME OF THE EUROPEAN UNION

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Goals for this session:

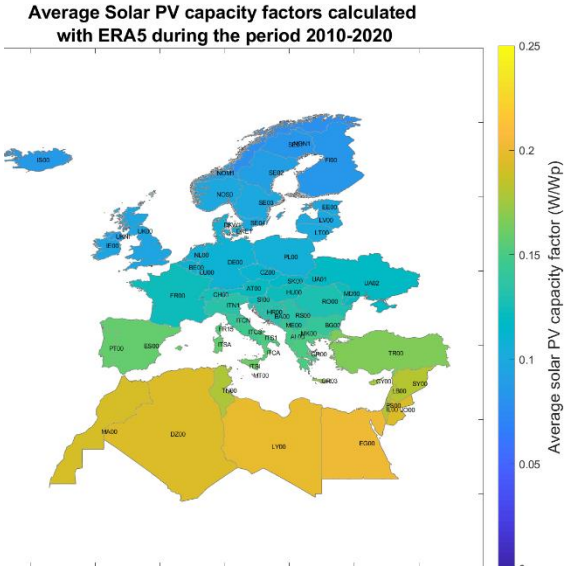
Discuss the Solar PV indicator in the scope of PECD

Target topics:

- Changes from transition PECDv3 to PECDv4
- Reference PV installed capacity & overplanting
- Differentiating PV technology typologies

Contrasting with Lot1

- Same methodology as for Lot1
- Specific end-user (ENTSO-E and TSOs)
- With already some results generated



Main changes from PECDv3 to PECDv4

- Move from default to a custom selection of algorithms
- Adjust exclusion areas
- Address assumptions on module geometry
- Address assumptions on reference installed capacity & overplanting

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- **Address assumptions on reference installed capacity & overplanting**

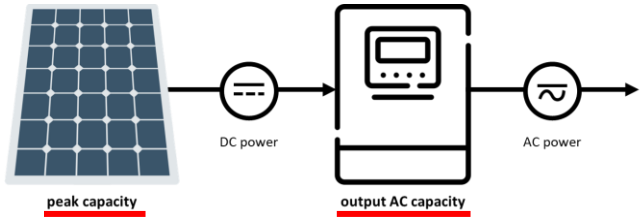
Grey elements are described in Annex. To be presented in C3S seminar (23 June 2026)

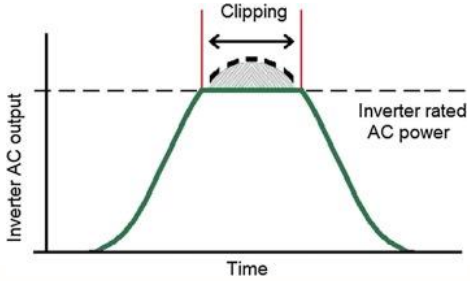
Reference installed capacity & overplanting

PV generation = Capacity Factor × PV Capacity

PV peak *vs* inverter AC capacity

- 1st is DC, expressed in Watt-peak (Wp), and defines overall PV profile
- 2nd, expressed in W, defines max output (if DC>AC, leads to clipping)

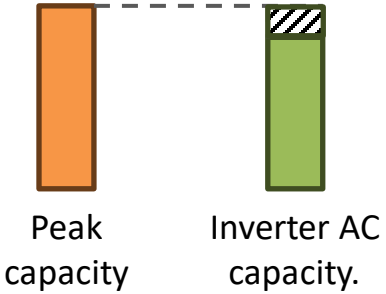




Source:
- Right, Serdio Fernández et al. (2016)

Reference installed capacity & overplanting

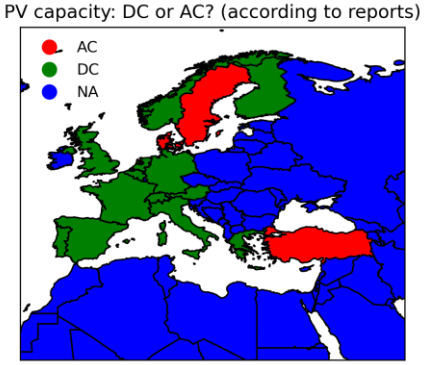
Overplanting: peak capacity > inverter ac capacity

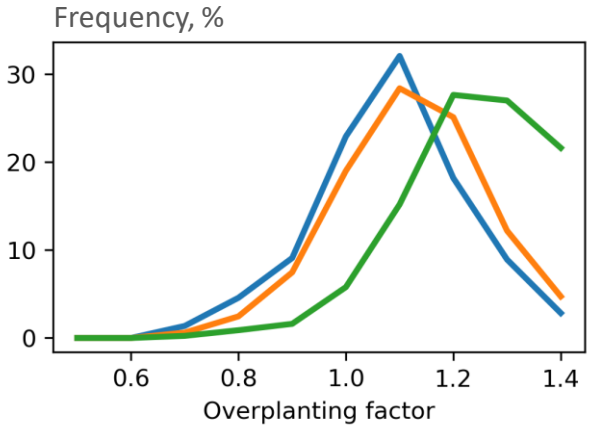


$$\text{Overplanting factor} = \frac{\text{Installed DC panel peak capacity}}{\text{Inverter AC capacity}}$$

Reference installed capacity & overplanting

There are national- and scale-based variations





>1 MWp

25 kWp – 1 MWp

<25 kWp

Data sources:

- Left, IEA PVPS National Survey Reports
- Right, Tracking the Sun initiative (USA)

Reference installed capacity & overplanting

The type of reference capacity impacts how overplanting is modelled and PV generation is calculated (c.f. Annex for equations)

Super important: ensure coherency between context & modelling workflow

- provide default values, but also allow end-users to define their context

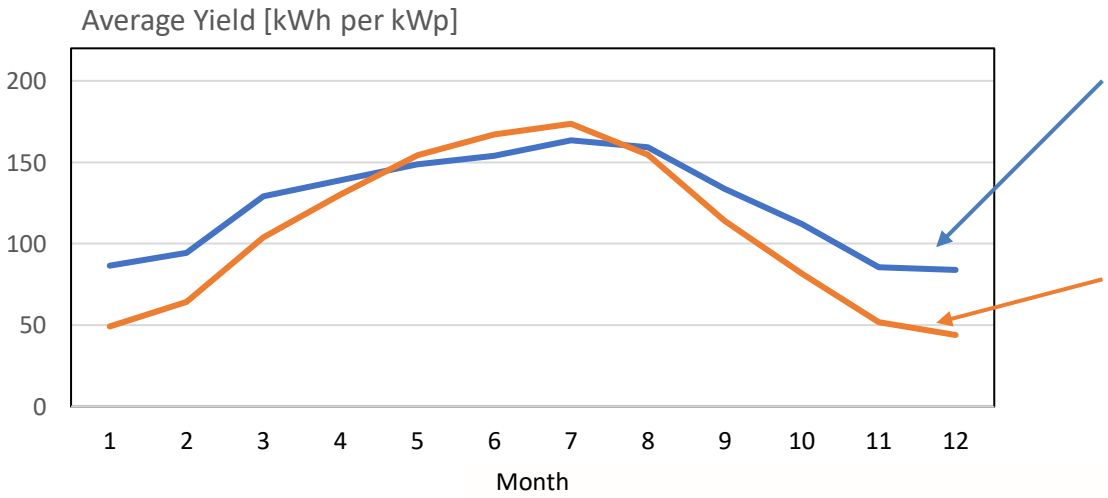
PV segmentation (typologies)

Differentiate segments such as residential, commercial, and utility-scale

- Context-specific model assumptions (e.g., tilt/azimuth, performance)
- Spatial placement considering land use (e.g., urban vs non-urban)
- Fixed vs single-axis tracking system, for utility-contexts

Example of industrial (nearly flat) PV

Fast deployment of industrial PV can change regional profile
(annual but also intra-day seasonality)



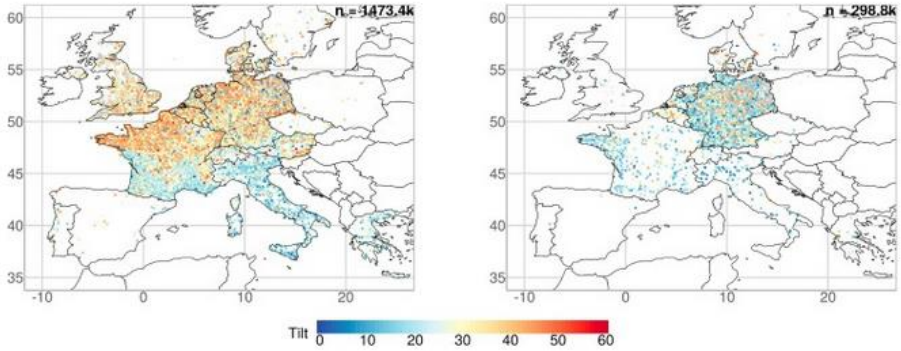
Corresponding intra-day profiles in annex

Input parameters regarding technology assumptions

Exploiting available datasets to properly describe PV typologies

- E.g., Killinger et al. 2018

$P_{pv} < 25\ kW_p$ $P_{pv} > 25\ kW_p$



Kick-off

PV segmentation is foreseen in future developments (2024)

A pilot project will be launched soon targeting the Italian market nodes. However, we will also open a parallel process to engage other TSOs, sharing results and collecting their needs, insights and data.

Take-away message

⚙ Discussing particularities of Solar PV indicator in the scope of PECD

⏳ Exciting new things in the pipeline

- Differentiation on user reference capacity and overplanting context
- Differentiation on PV typology
  - Pilot to start already this year with Italian TSO (Terna)

Naturally, the outcomes of each Lot benefits the other

Would like to thank the C3S & ENTSO-E teams for their collaboration

Feel free to reach us by e-mail at:

- yves-marie.saint-drenan@minesparis.psl.eu
- rodrigo.amaro_e_silva@minesparis.psl.eu

ANNEXES

Reference installed capacity & overplanting

If reference capacity is of inverter (AC)

$$PV_{gen}^{*} = \min(PV_{CF} * OF, 1) * P_{inverter,AC}$$

If reference capacity is of PV (peak, DC)

$$Pv_{gen}^{*} = \min\left(PV_{CF}, \frac{1}{OF}\right) * P_{PV,peak}$$

Overbuilding
Clipping (normalized output ≤ 1)
Convert to generation