SEAC

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What is SEAC?

- Solar Energy Application Centre, founded in 2012
- Development of new solar energy applications and markets
- In 2016: 17 projects with 41 companies
- Activities: Benchmarking → Prototyping → Field testing → Business modeling
- Offices at High Tech Campus in Eindhoven
- Outdoor field test location: SolarBEAT

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What is SolarBEAT?

- Test facility for outdoor performance research
- 9 independent measurement positions
- Typical: one full year because seasonal effects
- Building integration
- Electrical integration
- Esthetics
- Solar electricity (PV) & solar heating & combi (PVT)

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SEAC/SolarBEAT big data?

- 24/7 all sensors synchronized within 3 seconds
- 749 sensors of 61 different types
- Sampling default: once per minute, but faster or slower adjusted project specific
- Capturing 2.533.982 datapoints per day
- Central SQL-server
- Project level user & psswrd

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Example Project “LOCI”

Product

- Prefab PV roof elements

Consortium

- SEAC, Zonnepanelen Parkstad, Unilin Insulation

Time line

- 2013: Project start up
- 2014: Demonstrator at SolarBEAT
- 2015: Commercial

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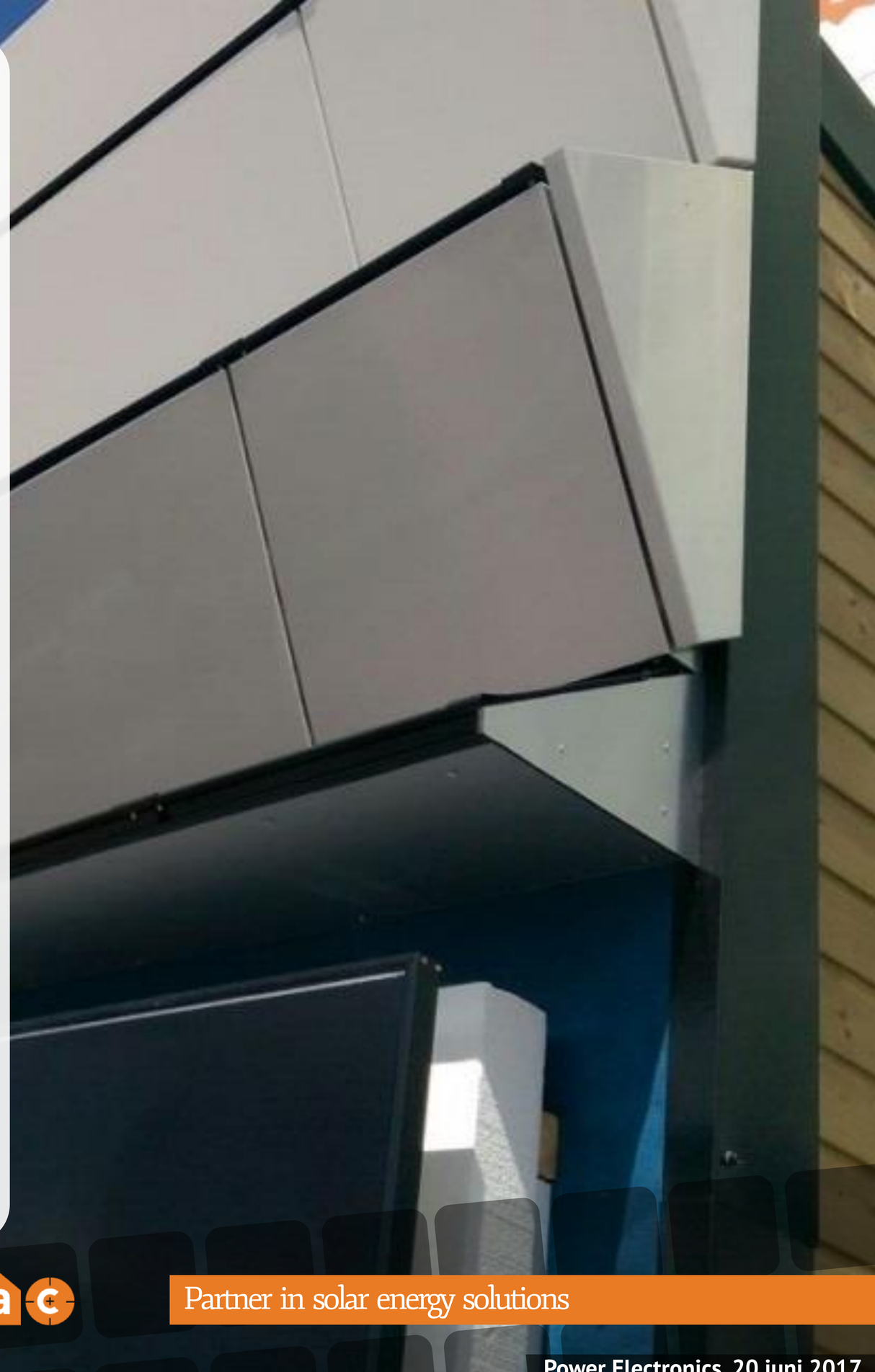
Example Project “ZonneGEVEL”

Product
- PV facade system

Consortium
- SEAC, SCX Solar, Zigzag Solar, Heliox, W/E adviseurs, Heijmans, …

Time line
- 2015: Project start up
- 2016: Demonstrator at SolarBEAT
- 2017: Pilot location



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Electrical integration

Within PV research field, specific sub-research field:

Module Level Power Management (MLPM) or
Module Level Power Electronics (MLPE)

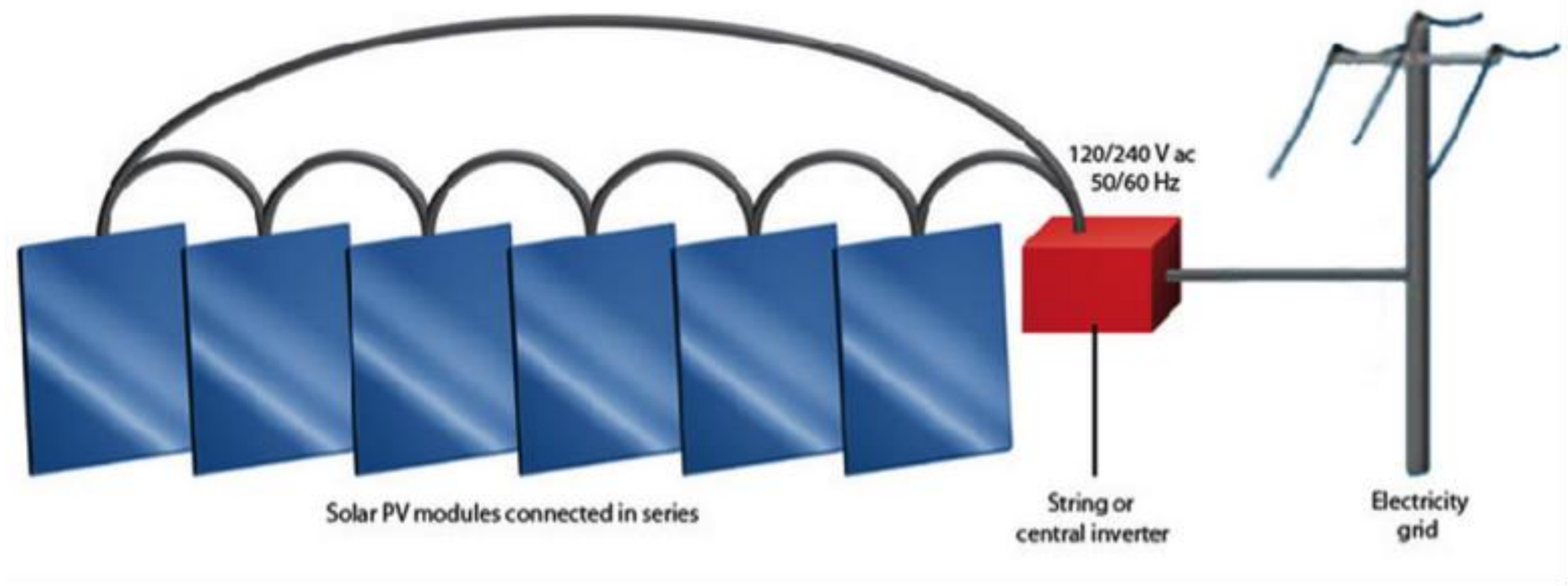
Category of main electrical architecture:

- ‘classical’: string inverter
- ‘new’: micro inverter
- ‘new’: power optimizer (PO)

Please note: every architecture has its + and –

Only presenting electrical efficiency

String inverter



MASTERVOLT

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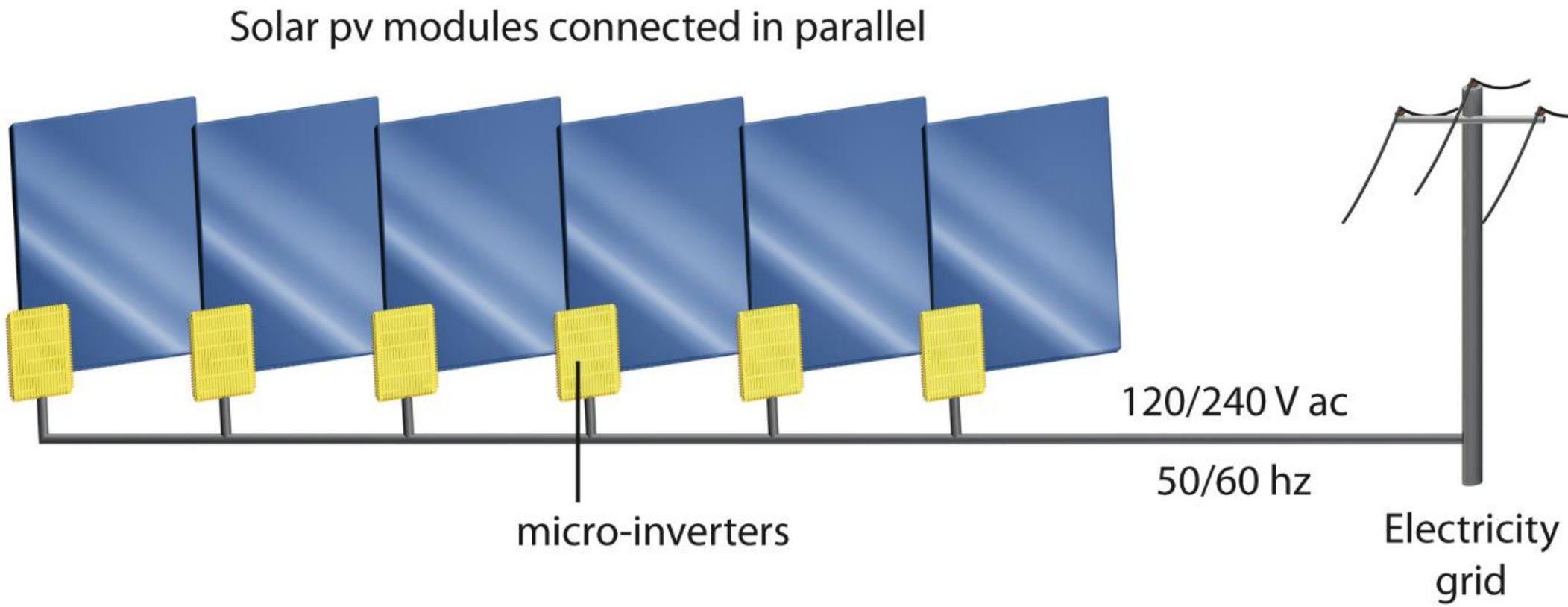
Micro inverter



heliox

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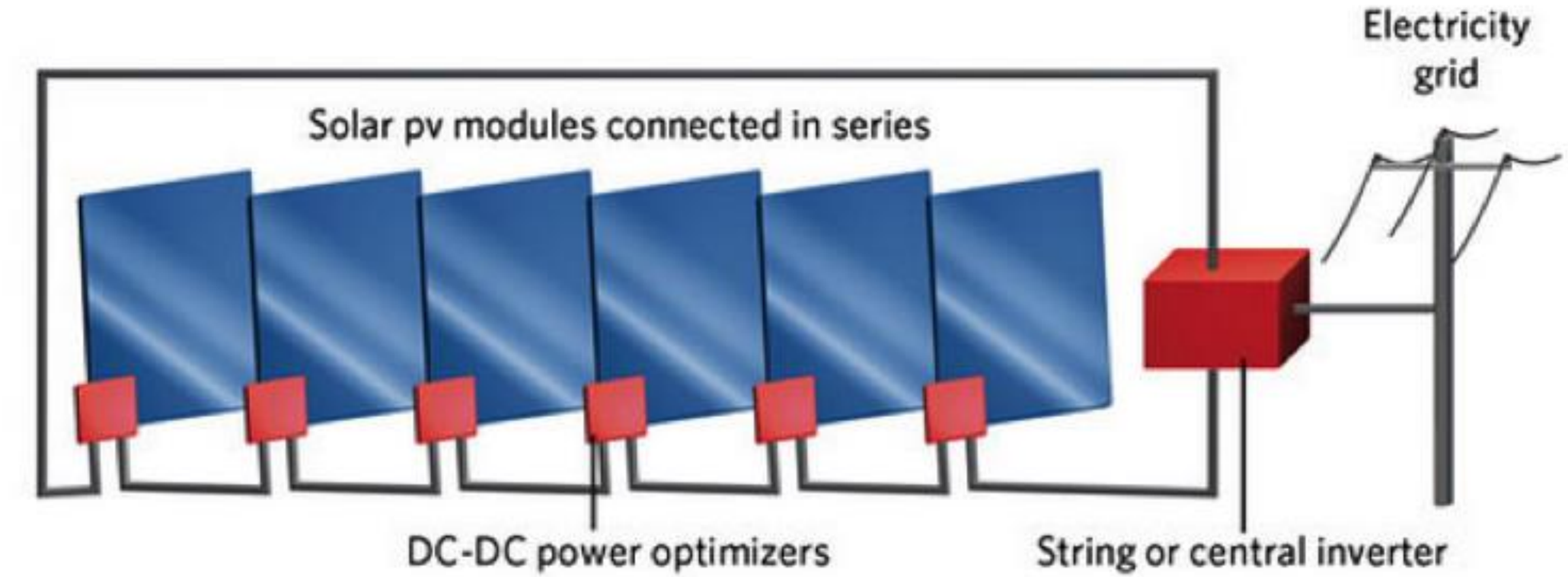
Power optimizer



femtogrid energy solutions

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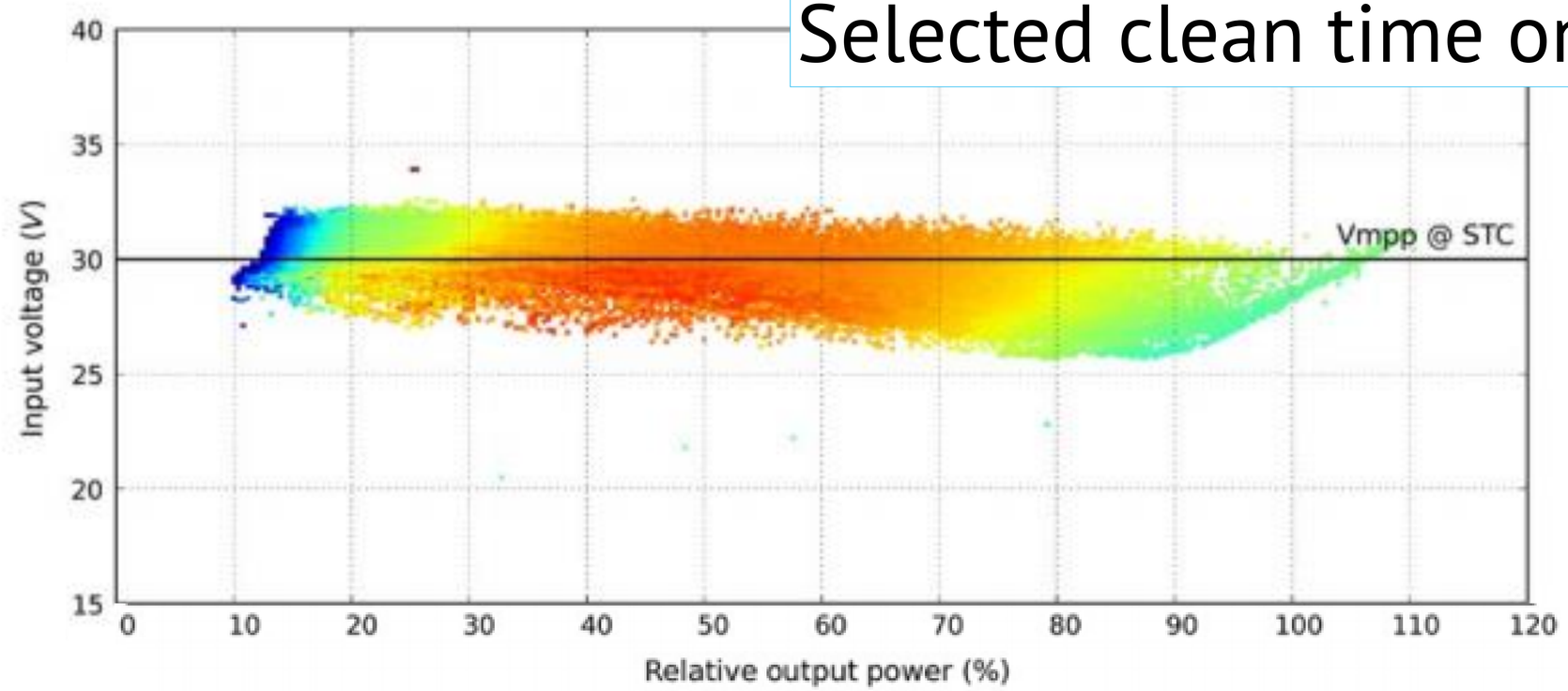
Experimental set-up with Yokogawa Power Analysers (7 pcs WT1800)

- Sampling rate every second !
- During a period of nearly a year

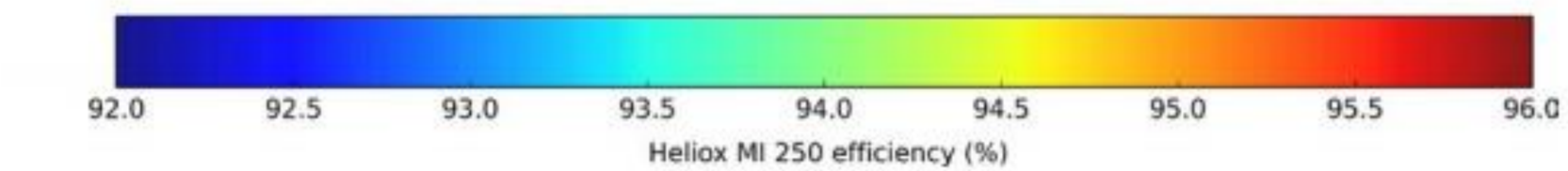
Micro inverter performance color graph

Selected clean time only!



Extract at Standard Test Conditions (STC):

- η_{Max}
- η_{Euro} (is weighted at various input power levels)
- η_{CEC} (also weighted at various input power levels, but slightly different definition)



Datasheets OK

Device	Voltage range	Max power measured	$\eta_{Euro\ measured}$	$\eta_{CEC\ measured}$	η_{Max}	η_{Max} @ power %	η_{Euro} datasheet	η_{Max} datasheet
Femtogrid PO310	30 ± 0.2	293 DC	96.56	96.67	97.5	39.93	97	>97
Soladin 1500 WEB	180 ± 0.2	1568 AC	94.74	94.65	95.4	25.38	95	95.6
Heliox SMI250	30 ± 0.2	270 AC	94.33	94.65	95.2	40.37	94.5	95.5

But, this is clean time only results.

Solar PV market will grow (also in NL)

Why integration in build environment?:

- There is not enough free space for (all) ambitions coming from mandatory energy transition
- NIMBY not only for Wind (eg: Volkskrant 3 juni j.l.)

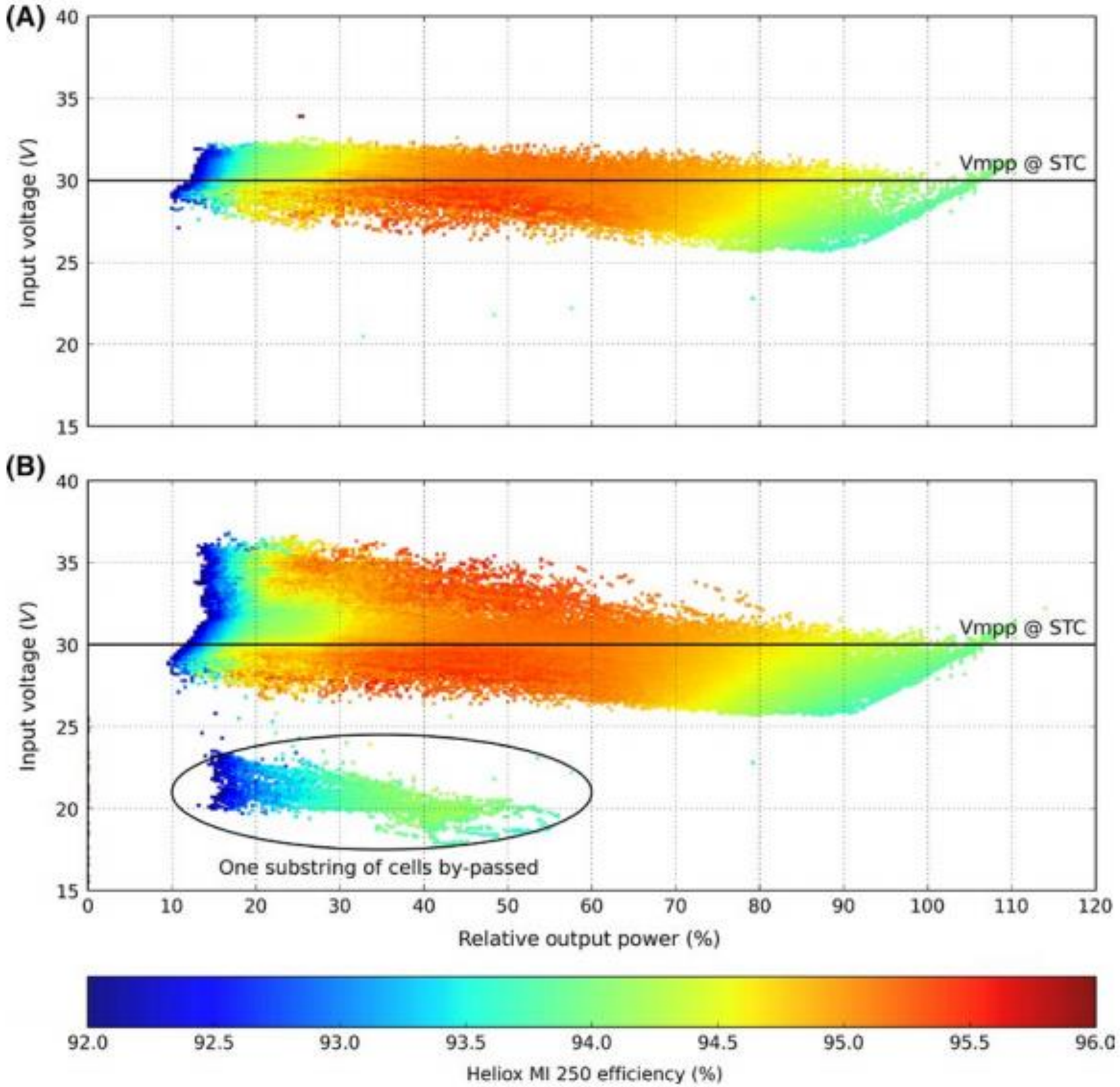
Schadow is inherent in build environment

Two types of shading analysed

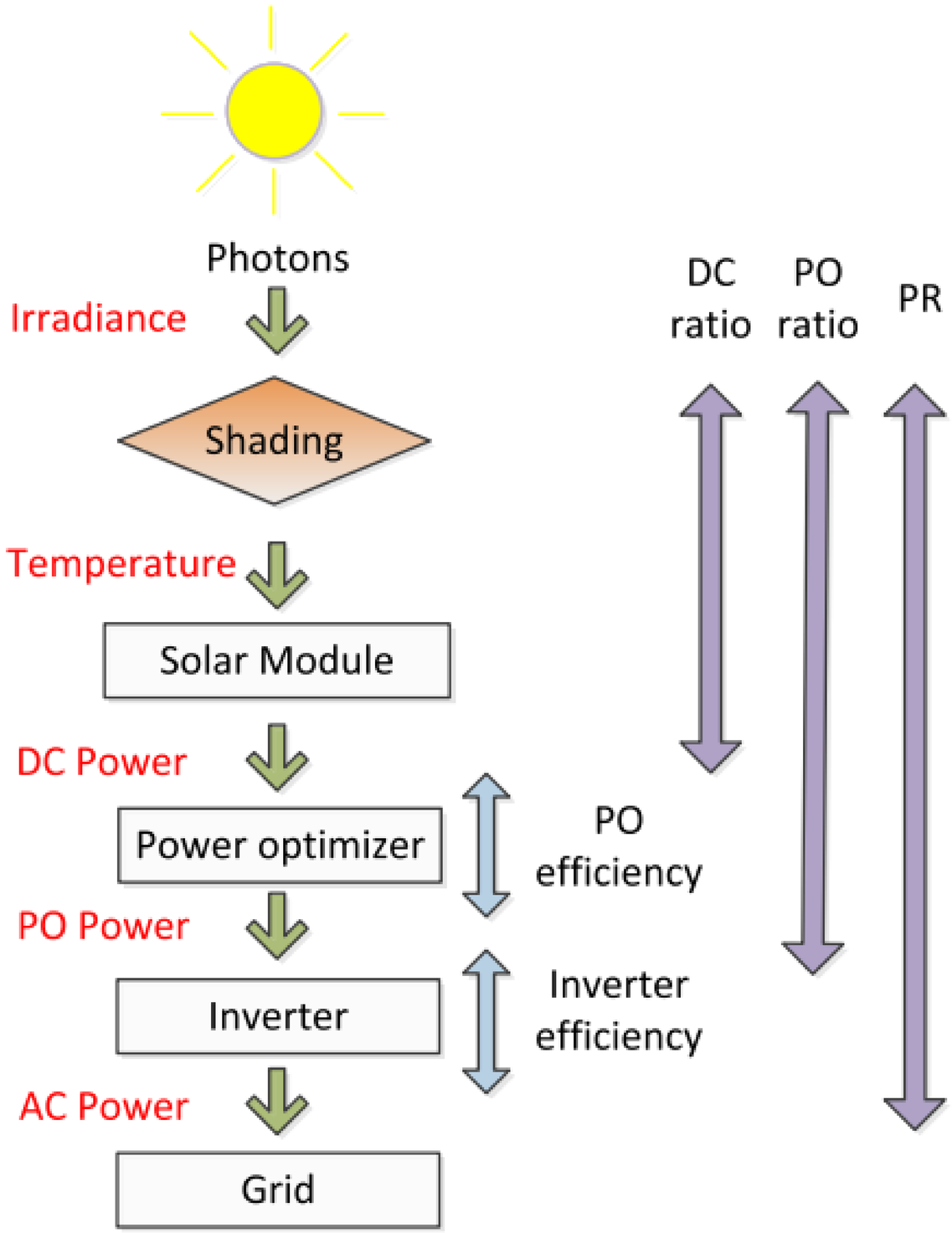
- Pole shading
- Row-to-row shading

Performance under shading

Shading gives more complex performance behaviour



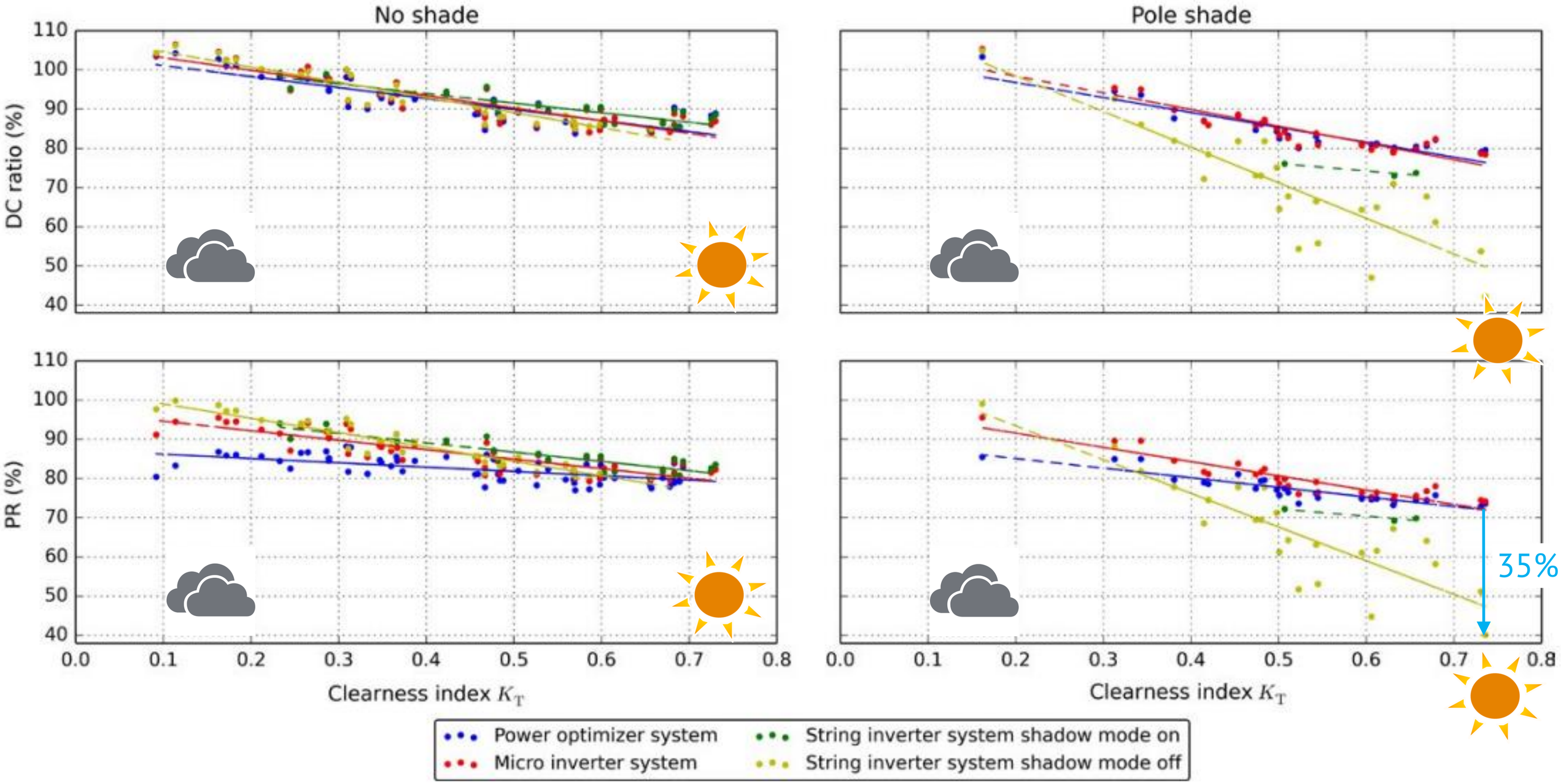
Performance PV-system



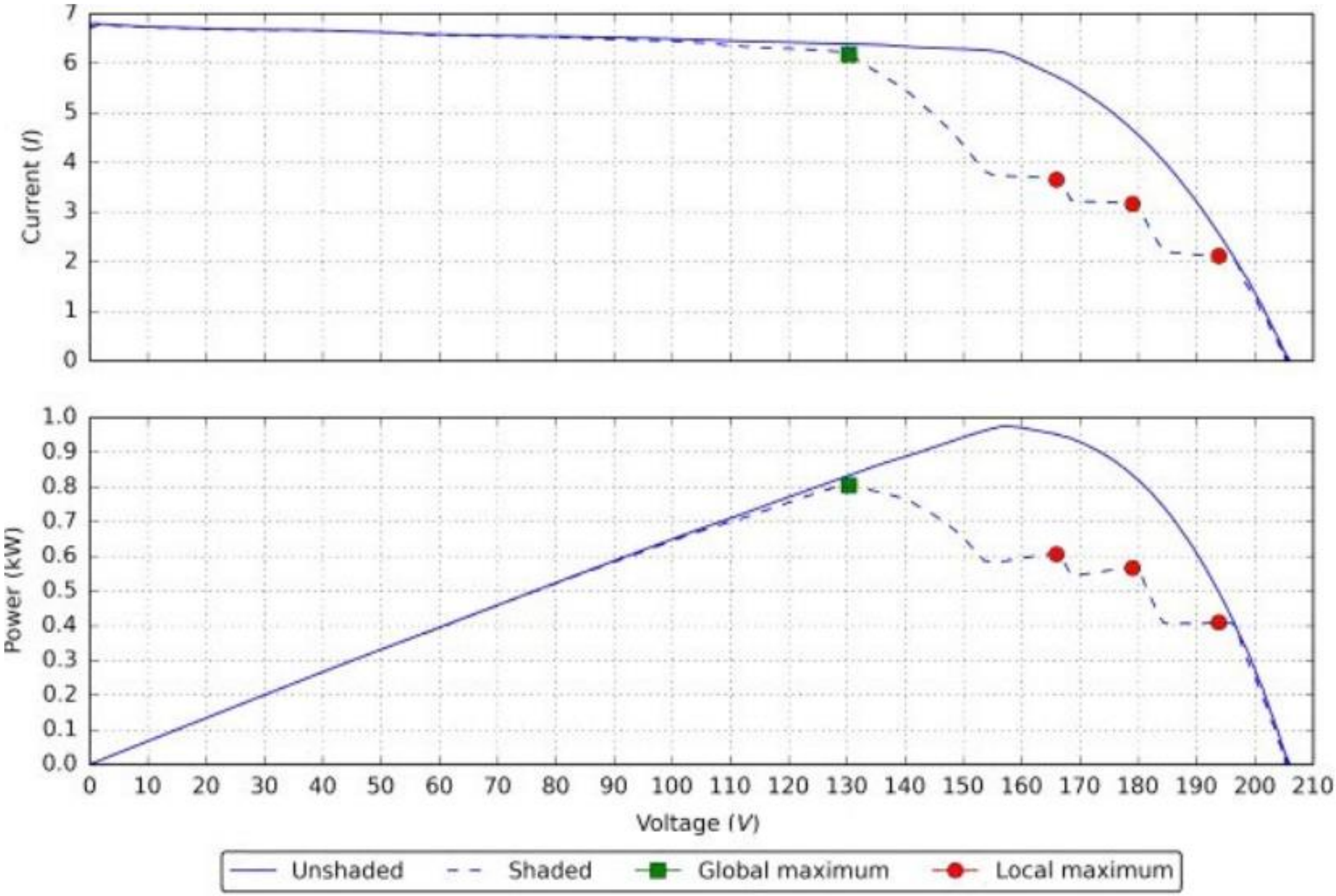
- Power optimizer diagram shown
- For micro and string inverter no seperate DC-DC step performed

Overall results (DC ratio and PR_AC)

- Clearness index K_T is indicator of amount of direct light
- In case of pole shade, MLPE up to 35% better! But…



Shadow mode in string inverter



Conclusions on MLPE

- UNSHADED-condition
    - Outdoor measured efficiencies of nominal operation perfectly in correspondence with data sheet values.
    - Classical architecture (string inverter) performs slightly better.
- SHADED-condition
    - MLPE can give up to 35% better energy yield at certain shading.
    - A string inverter with shadow mode can reduce this advantage to 5%.
- ‘Disclaimer’
    - Experiment done on 1 string of 6 PV-panels in series. For multiple parallel strings, advantage of MLPE could be higher.
    - Conclusions will be dependent on specific choice of equipment, so not in general terms of ‘any micro’, ‘any PO’, or ‘any string inverter’

https://www.seac.cc/en/publications/

Thank you for your attention!

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