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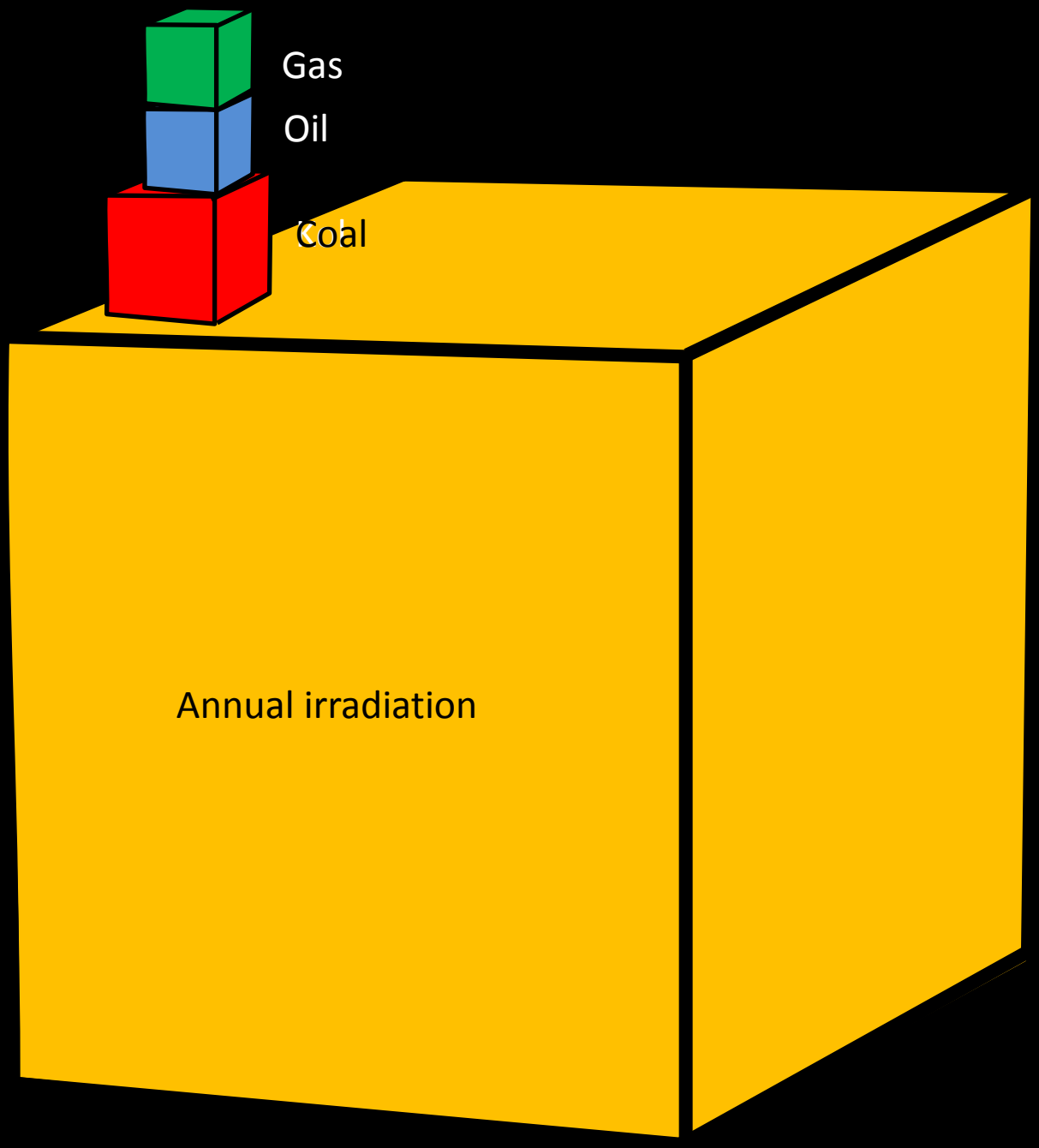
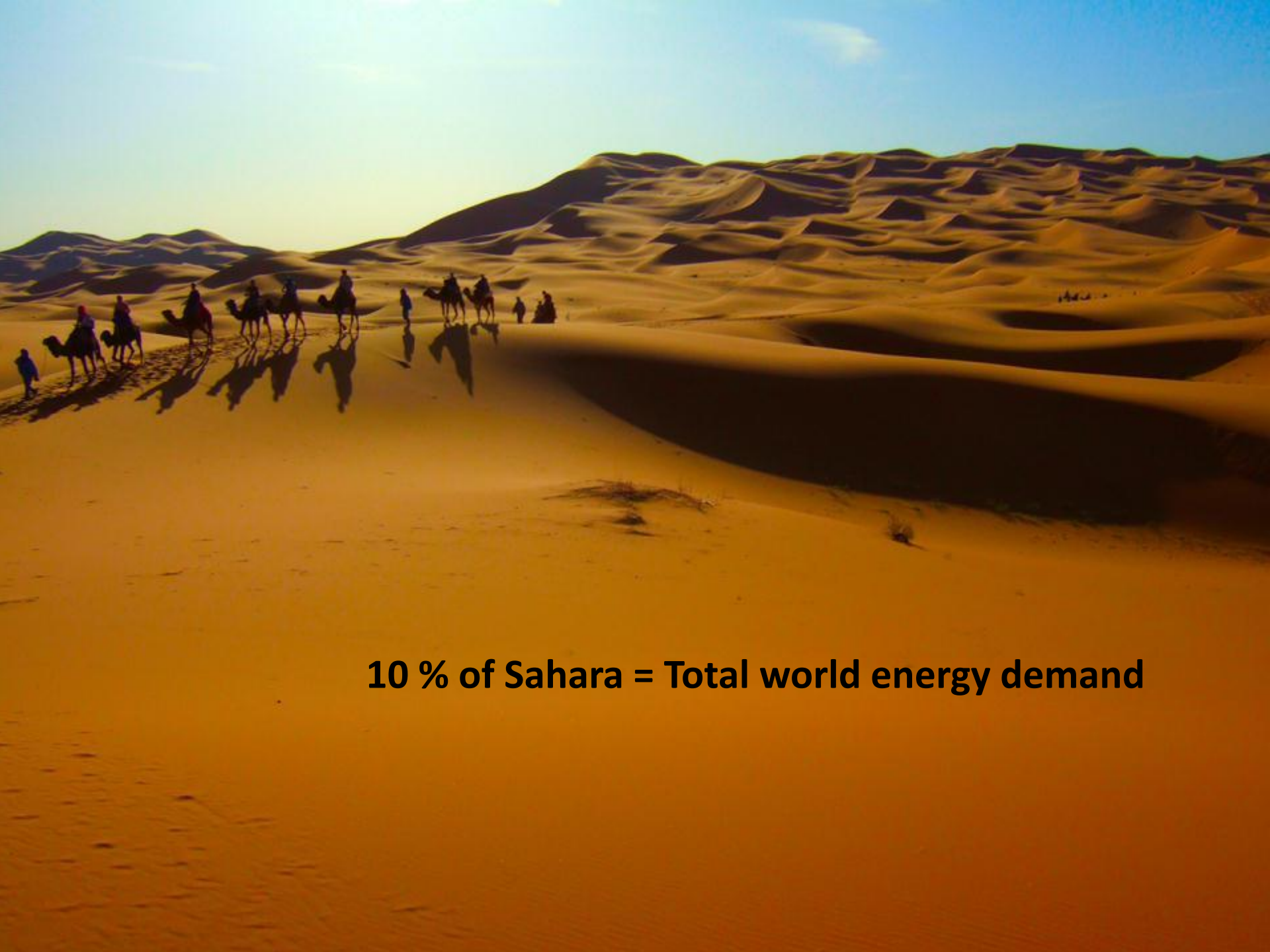
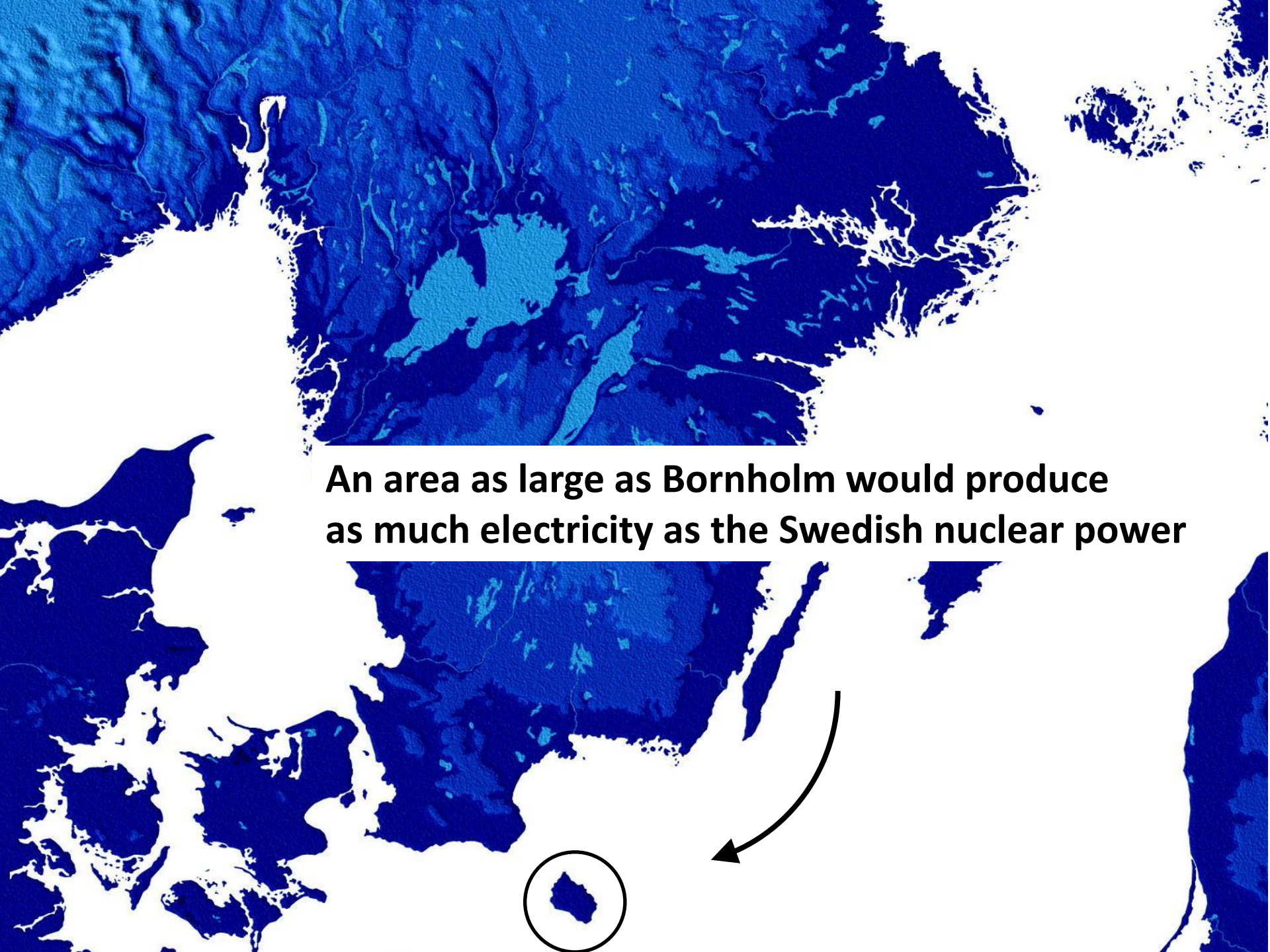
Potential?


Gas
Oil
Coal
Annual irradiation


10 % of Sahara = Total world energy demand


An area as large as Bornholm would produce
as much electricity as the Swedish nuclear power


But this is were the real potential is

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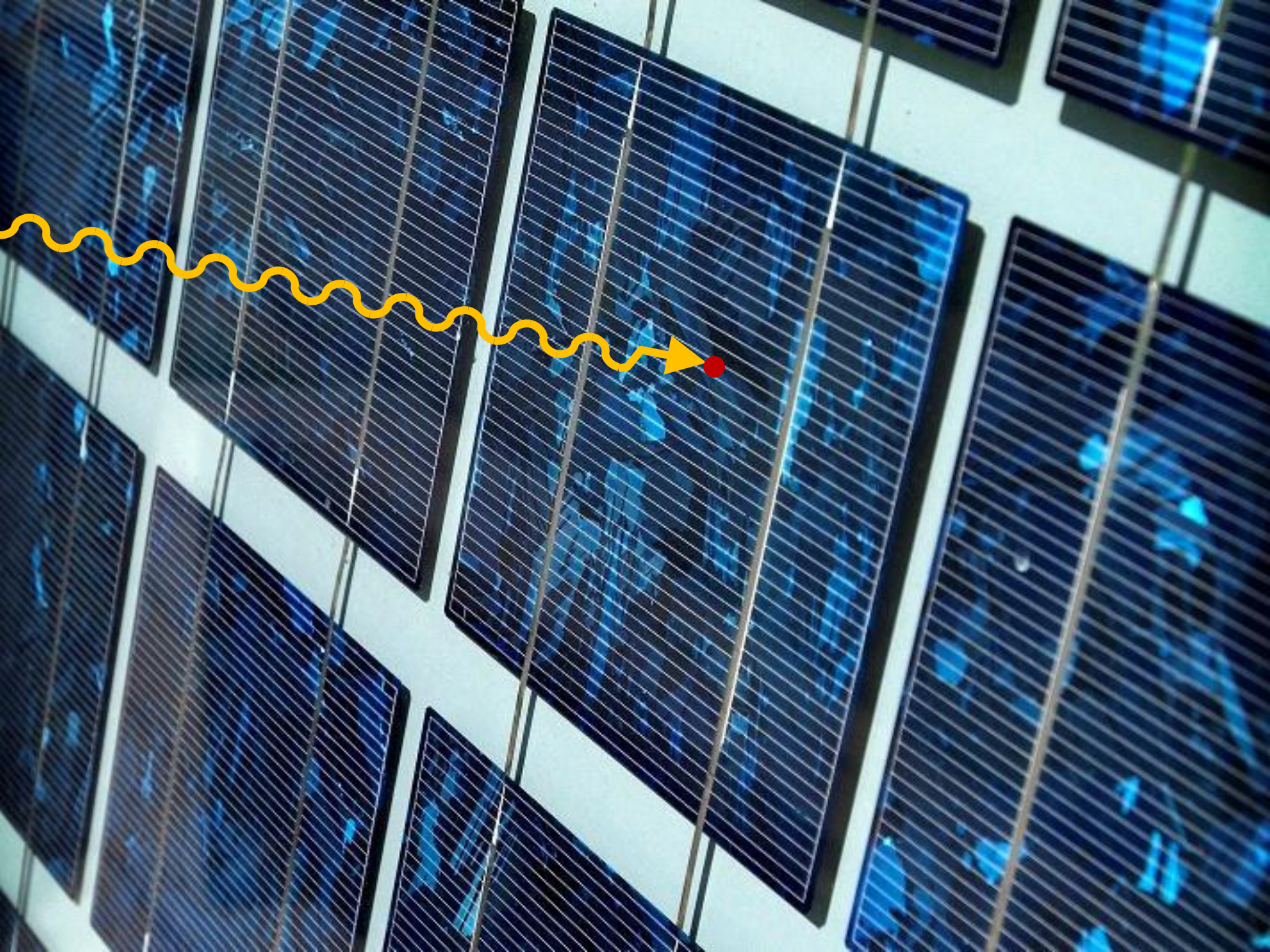
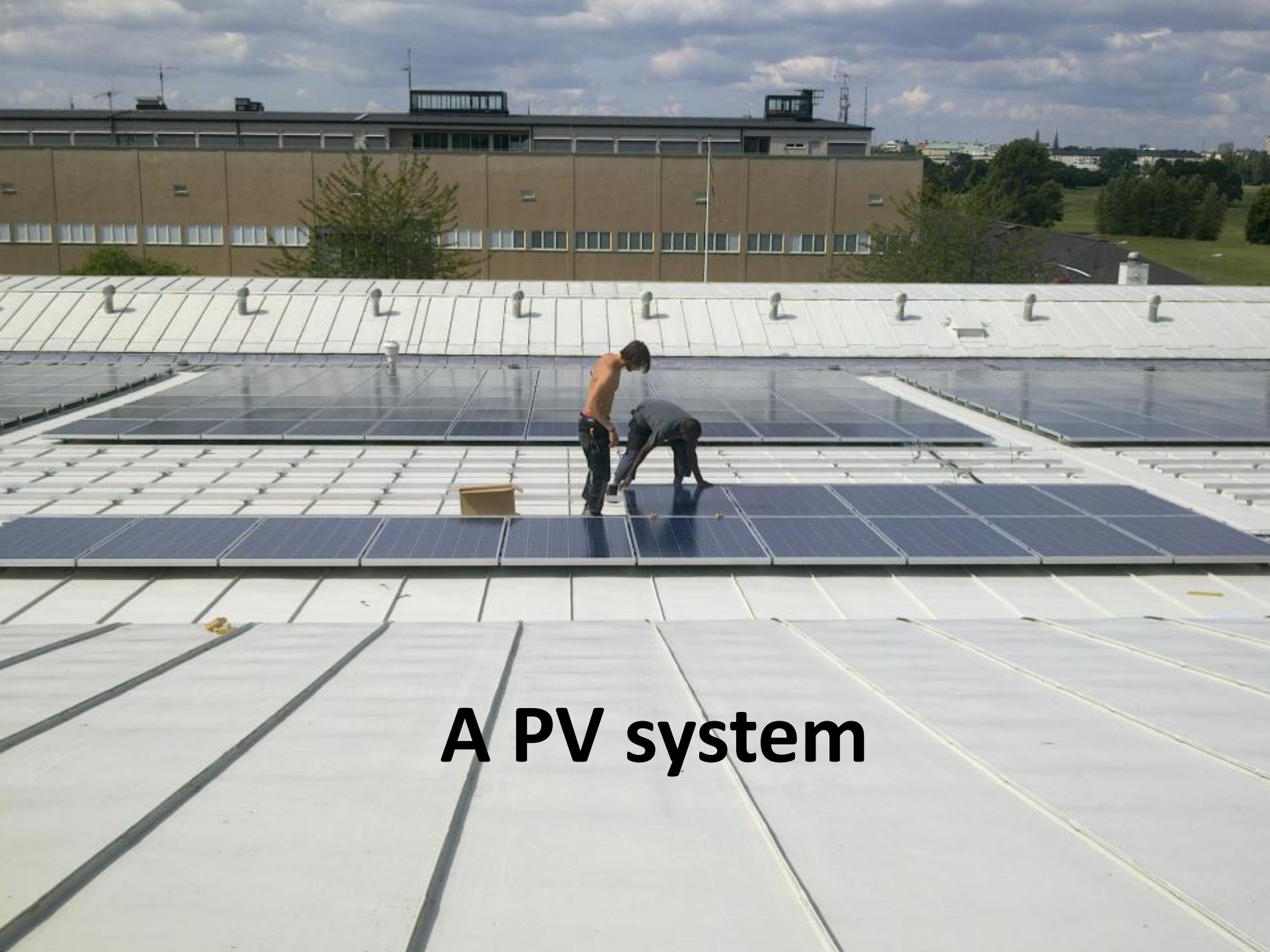
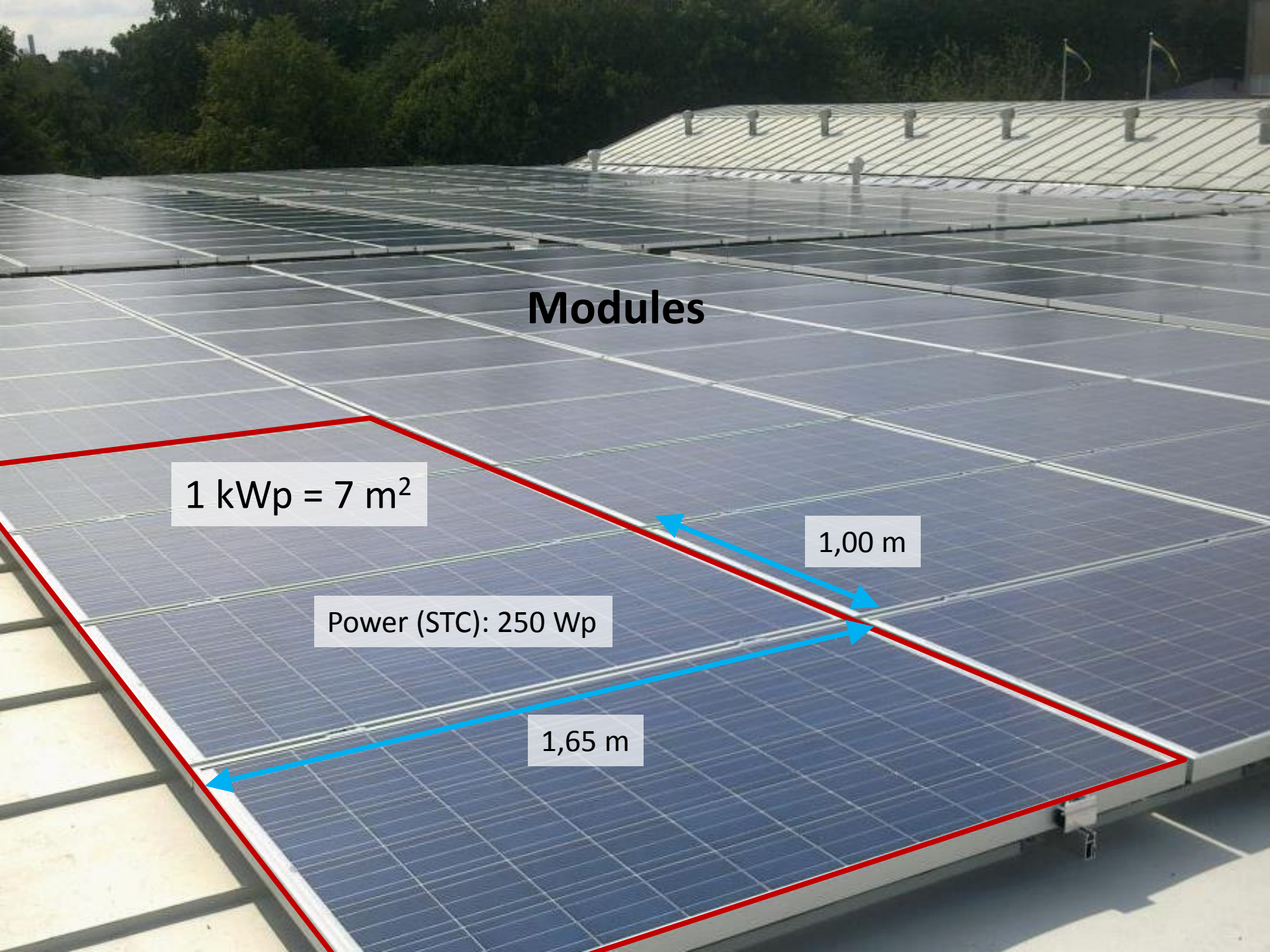
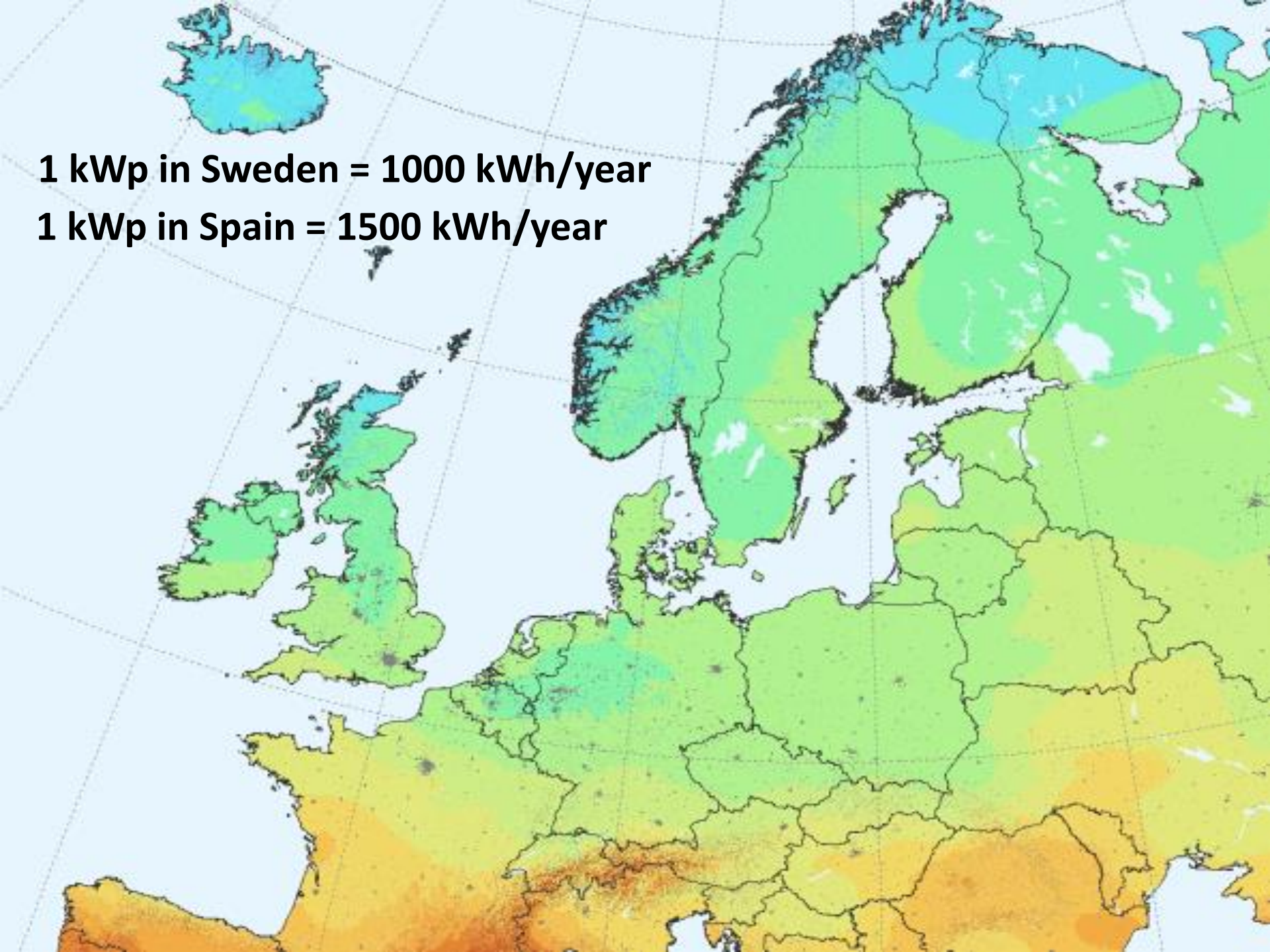
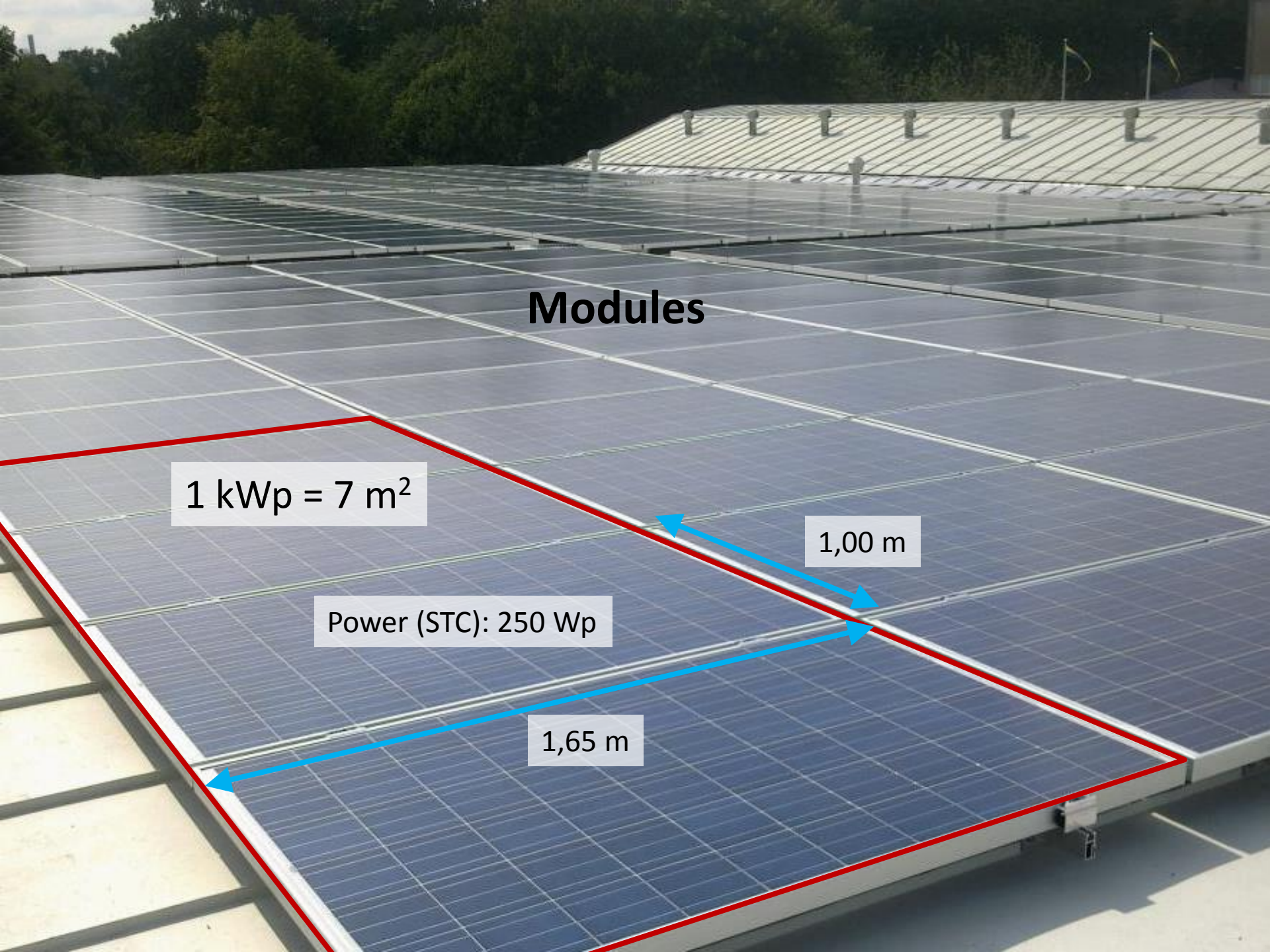
But how does it work?




A PV system


Modules
1 kWp = 7 m²
1,00 m
Power (STC): 250 Wp
1,65 m


1 kWp in Sweden = 1000 kWh/year
1 kWp in Spain = 1500 kWh/year


Modules
1 kWp = 7 m²
1,00 m
Power (STC): 250 Wp
1,65 m


Inverters

Connection to the grid

PV modules

Inverters

AC-cabinet

Central

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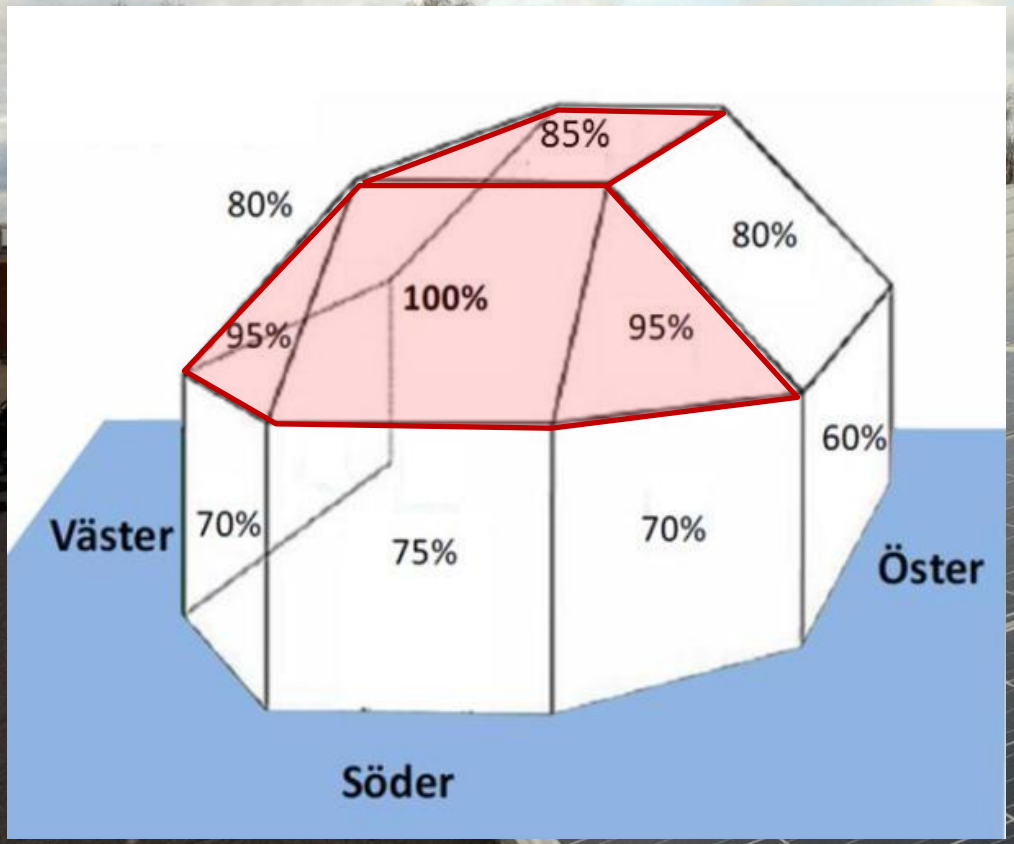
And a few words on how to install

Directions not as important as generally assumed




MERCEDES-BENZ

Market developments

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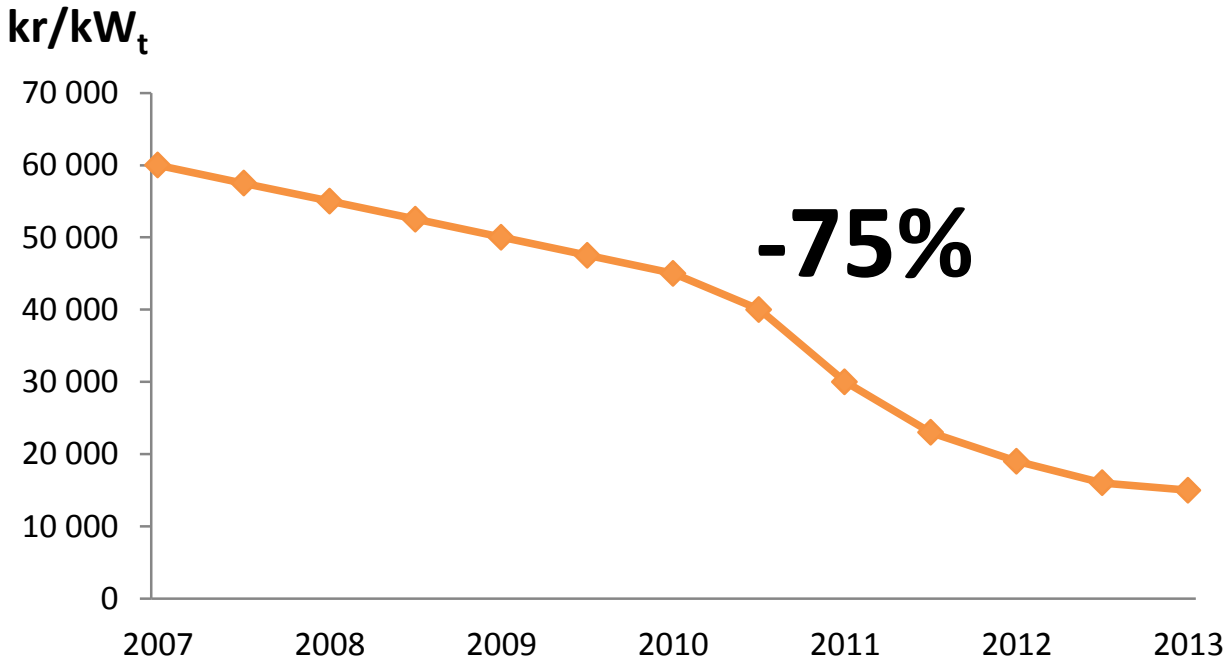
Price reduction



Global Annual installations (EPIA)

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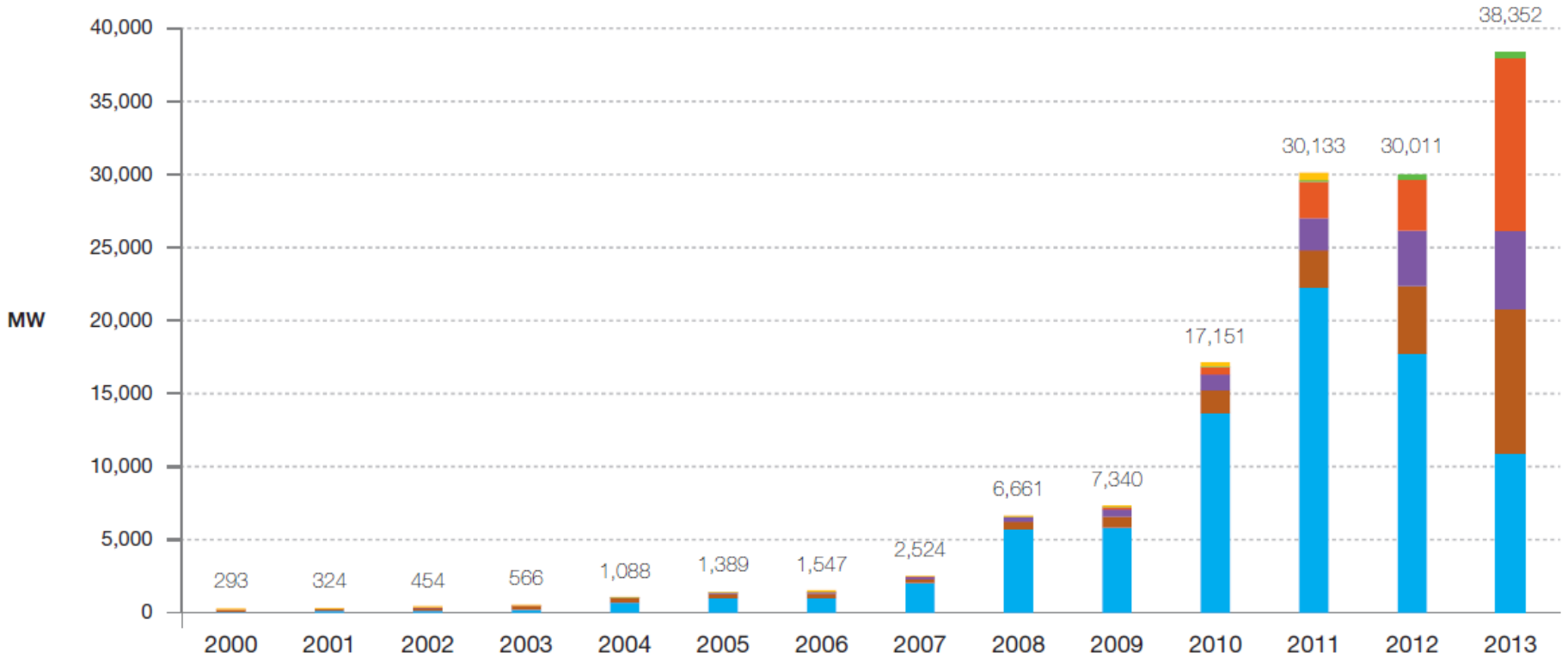

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
RoW	88	56	80	77	29	10	105	42	76	80	284	508	n/a	n/a
MEA	n/a	n/a	n/a	n/a	1	0	0	1	1	22	55	125	365	383
China	19	5	19	10	10	8	10	20	40	160	500	2,500	3,500	11,800*
Americas	2	3	30	48	61	82	110	166	306	500	1,082	2,181	3,774	5,362
APAC	126	128	190	230	282	304	325	271	530	745	1,578	2,562	4,646	9,833
Europe	58	133	134	202	705	985	997	2,023	5,708	5,833	13,651	22,259	17,726	10,975
Total	**293**	**324**	**454**	**566**	**1,088**	**1,389**	**1,547**	**2,524**	**6,661**	**7,340**	**17,151**	**30,133**	**30,011**	**38,352**

Cumulative global installations (EPIA)

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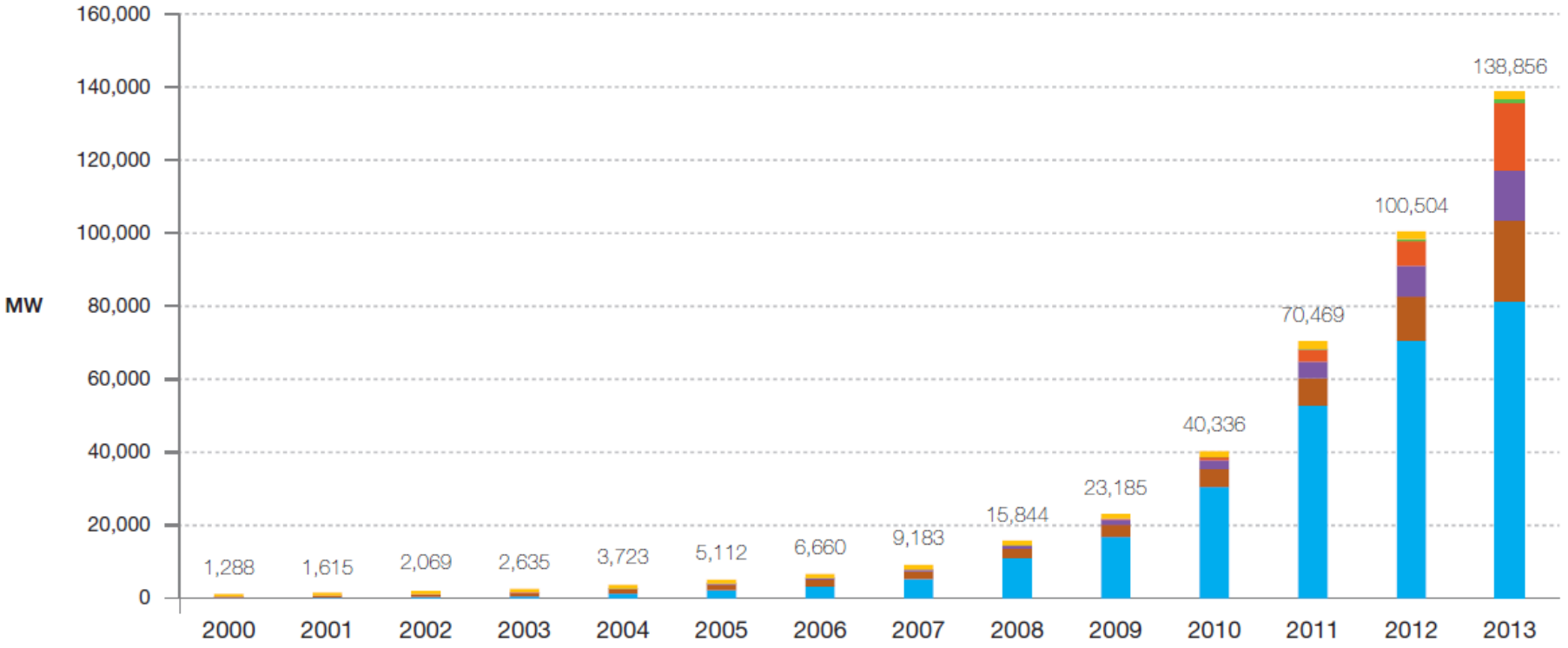

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
RoW	751	807	887	964	993	1,003	1,108	1,150	1,226	1,306	1,590	2,098	2,098	2,098
MEA	n/a	n/a	n/a	n/a	1	1	1	2	3	25	80	205	570	953
China	19	24	42	52	62	70	80	100	140	300	800	3,300	6,800	18,600
Americas	21	24	54	102	163	246	355	522	828	1,328	2,410	4,590	8,365	13,727
APAC	368	496	686	916	1,198	1,502	1,827	2,098	2,628	3,373	4,951	7,513	12,159	21,992
Europe	129	265	399	601	1,306	2,291	3,289	5,312	11,020	16,854	30,505	52,764	70,513	81,488
Total	**1,288**	**1,615**	**2,069**	**2,635**	**3,723**	**5,112**	**6,660**	**9,183**	**15,844**	**23,185**	**40,336**	**70,469**	**100,504**	**138,856**

Cumulative PV installations per region

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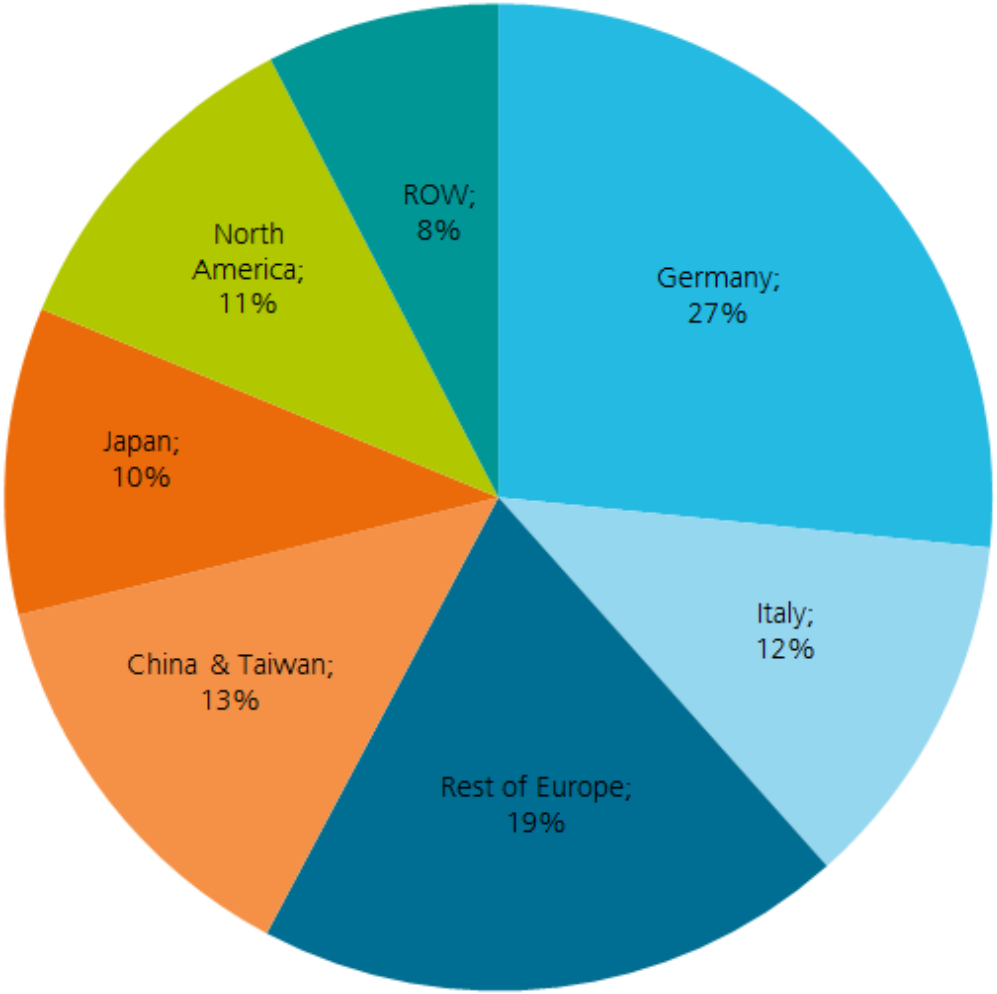

From Fraunhofer PV report 2014

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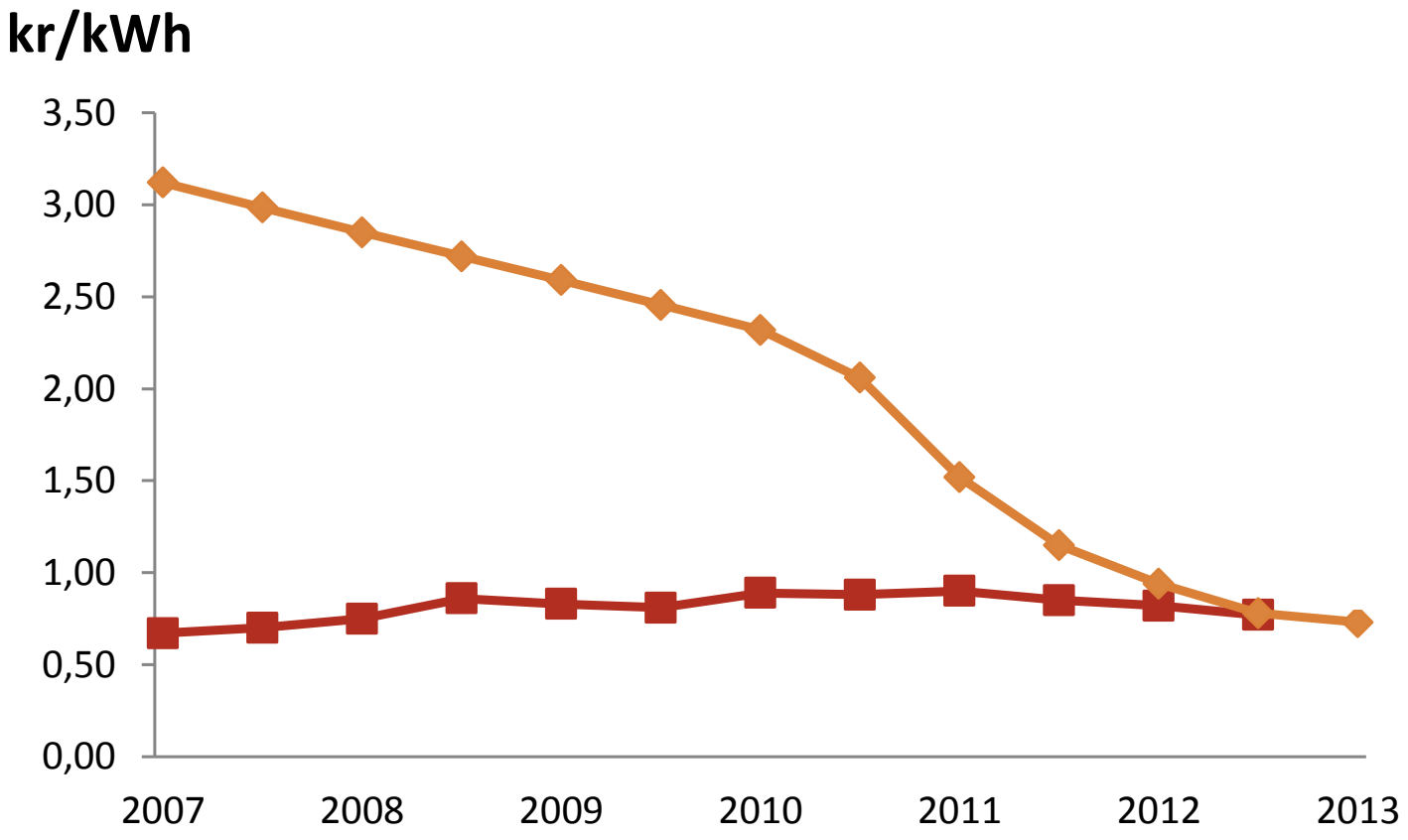
Cost of electricty from the grid increasing



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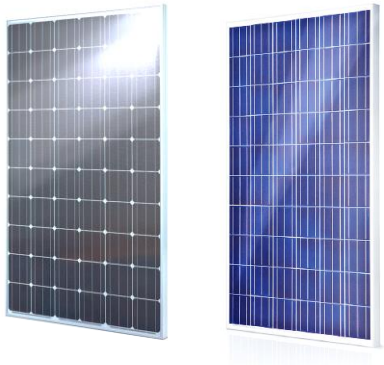
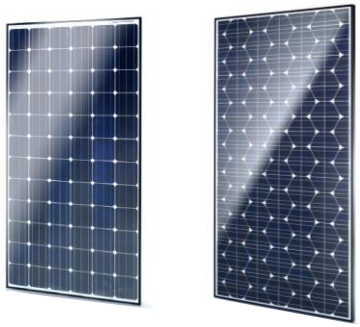
Cells and Modules

Different types of PV modules

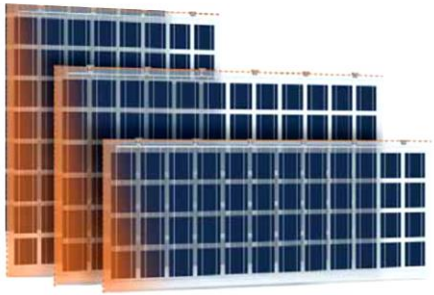


Standard (Silicon based)

Thin film



High efficiency



Custom made

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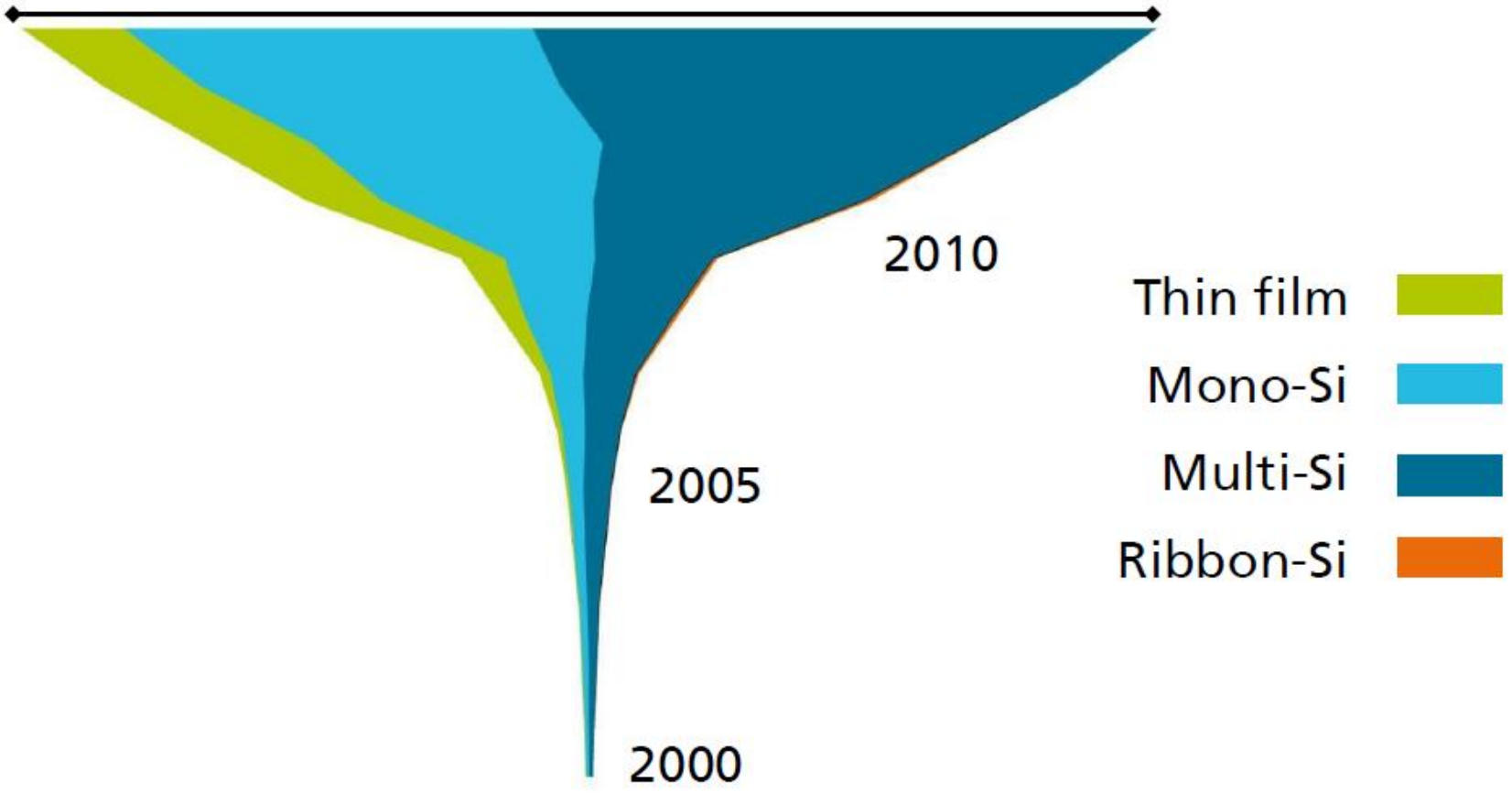
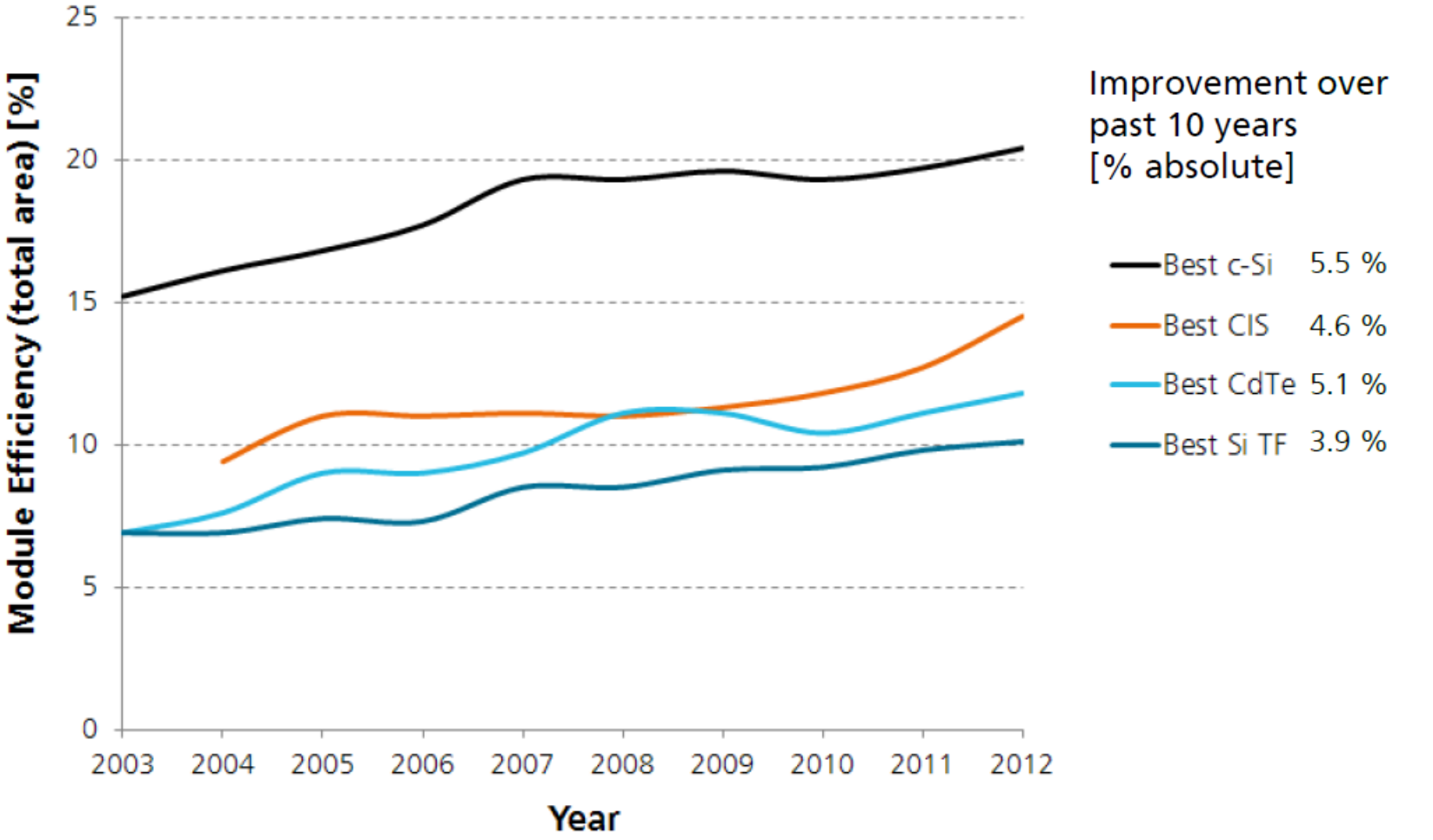
Global Annual PV Production by Technology



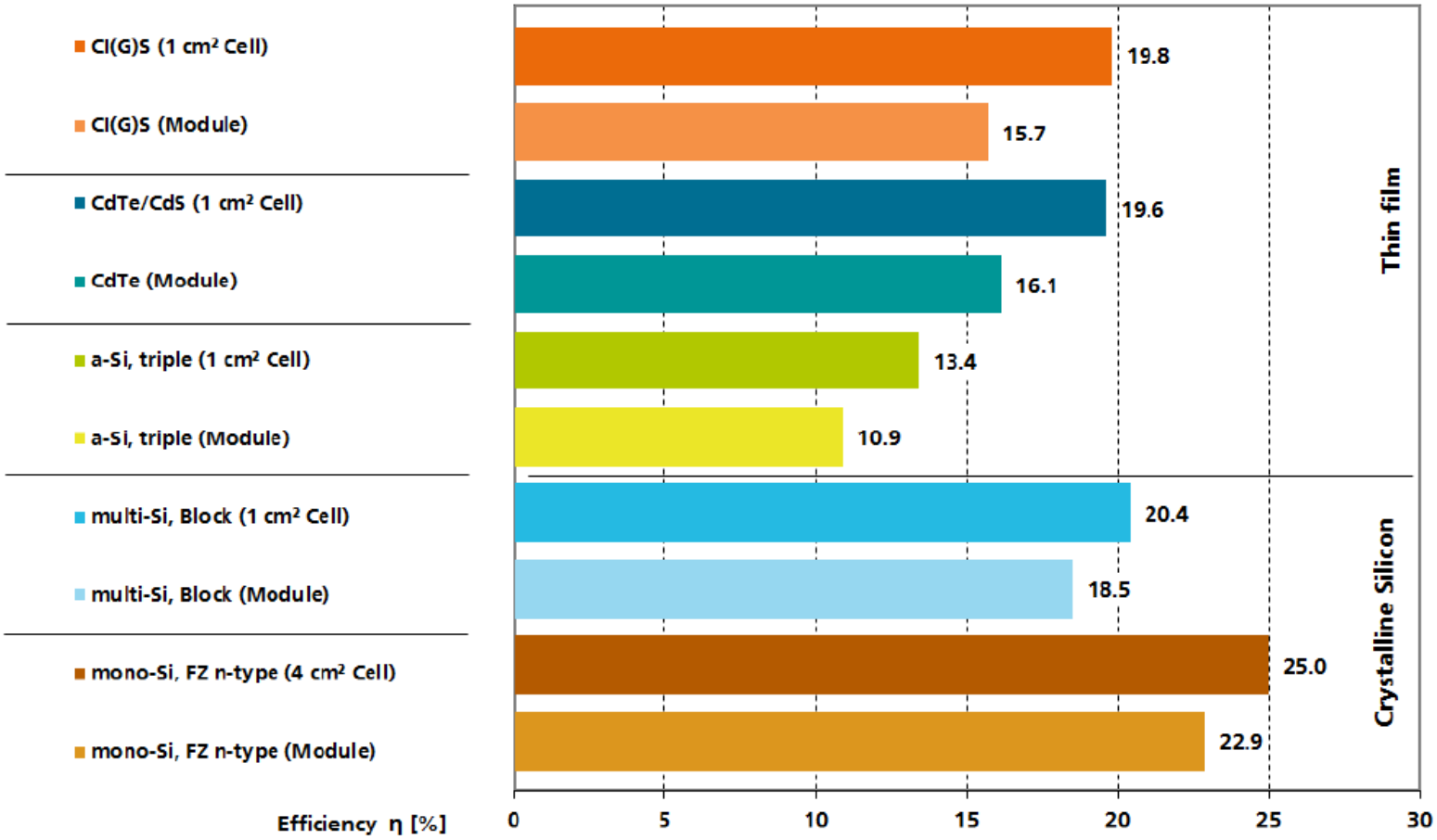
Efficiency slowly increasing



Data: Photon 2/2003-2009, Photon Profi 2/2010-2/2012. Graph: Willeke Fraunhofer ISE 2013

From Fraunhofer PV report 2014

State of the art



Data: Green et al.: Solar Cell Efficiency Tables,(Version 1-40), Progress in PV: Research and Applications 2012. Graph: PSE AG 2014

From Fraunhofer PV report 2014

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Inverters

Inverters – a possible support to the grid

Active Power Reduction

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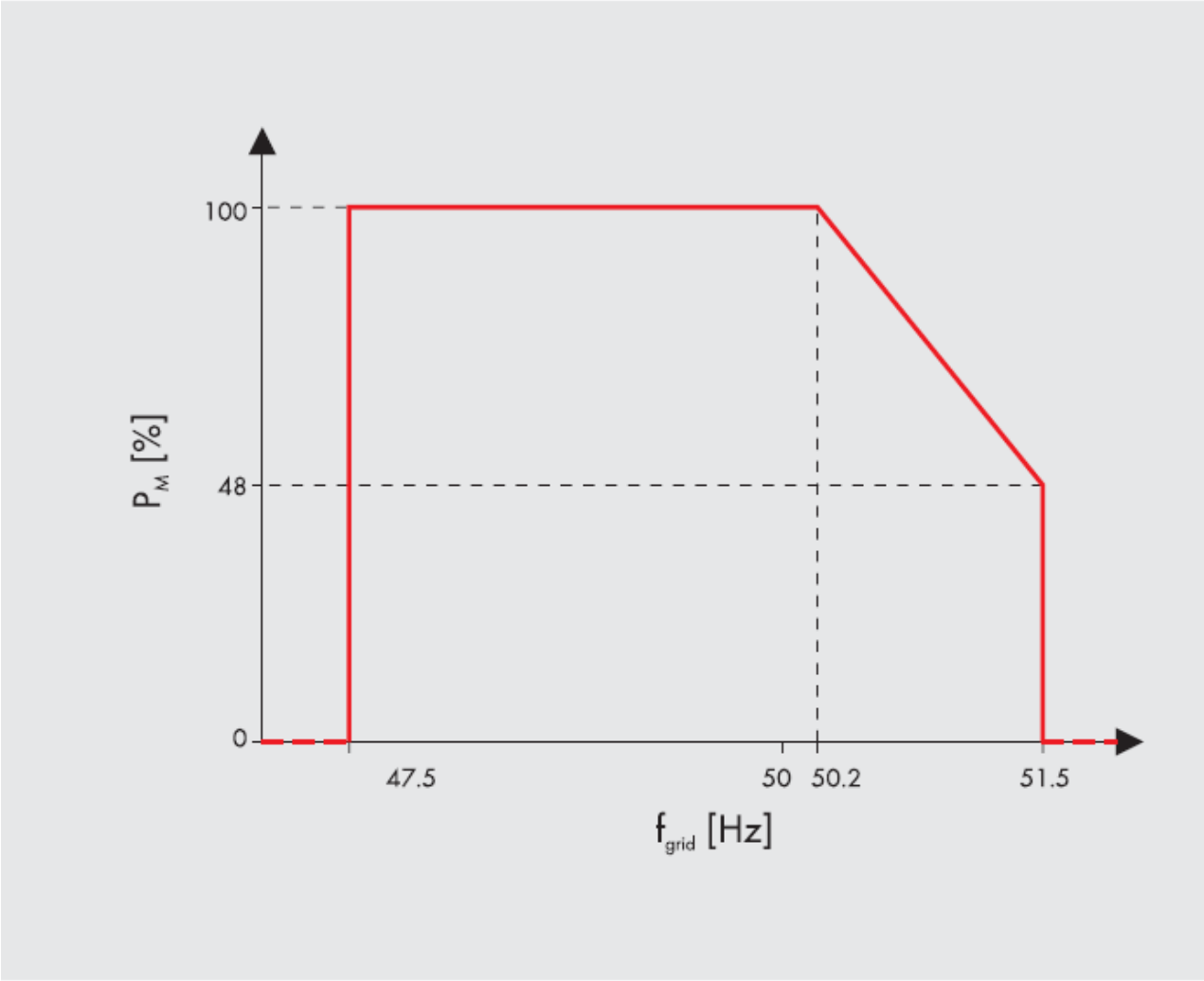
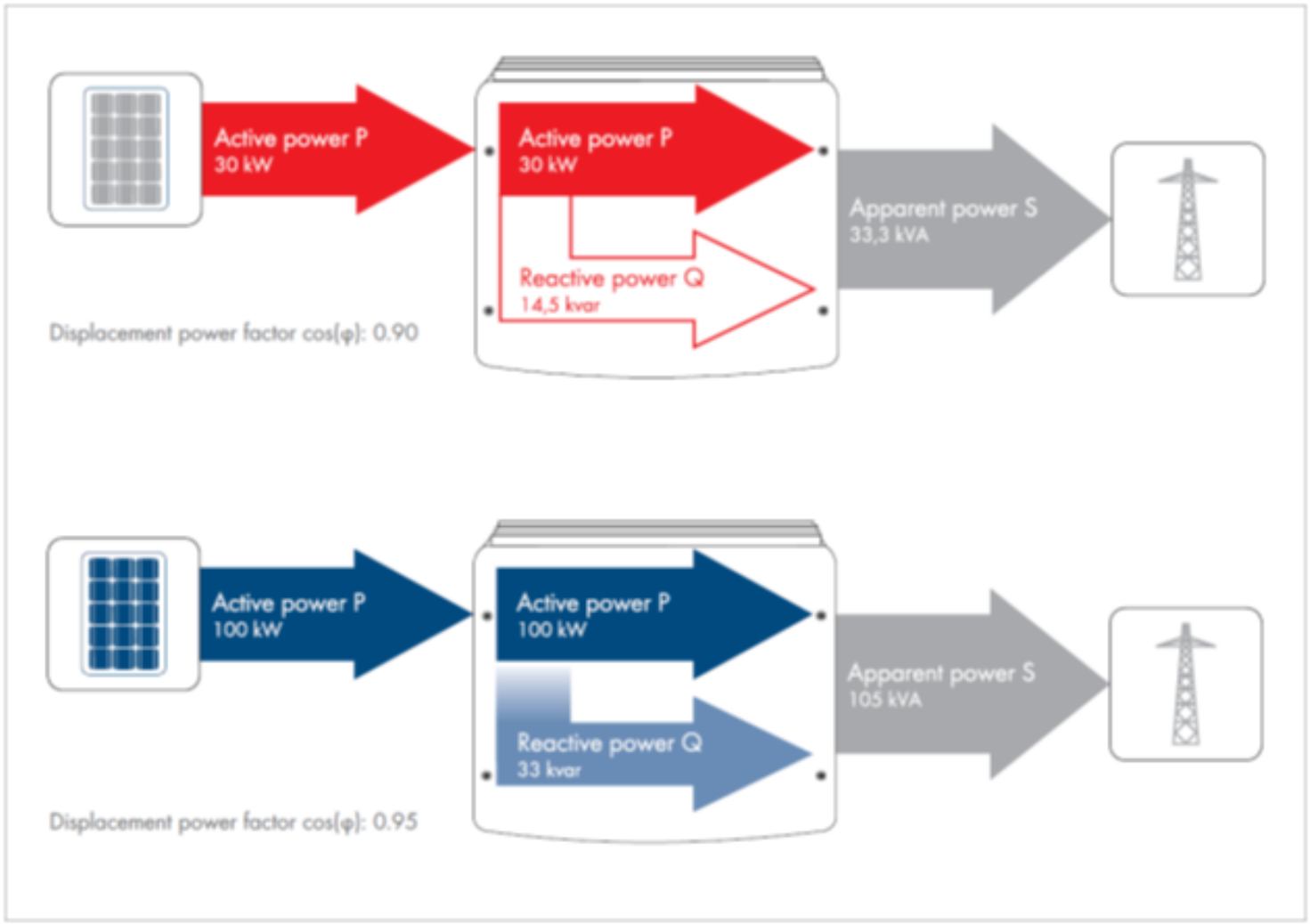


Picture: SMA Solar Technology AG

Provision of reactive power



Picture: SMA Solar Technology AG

Remote power limitation

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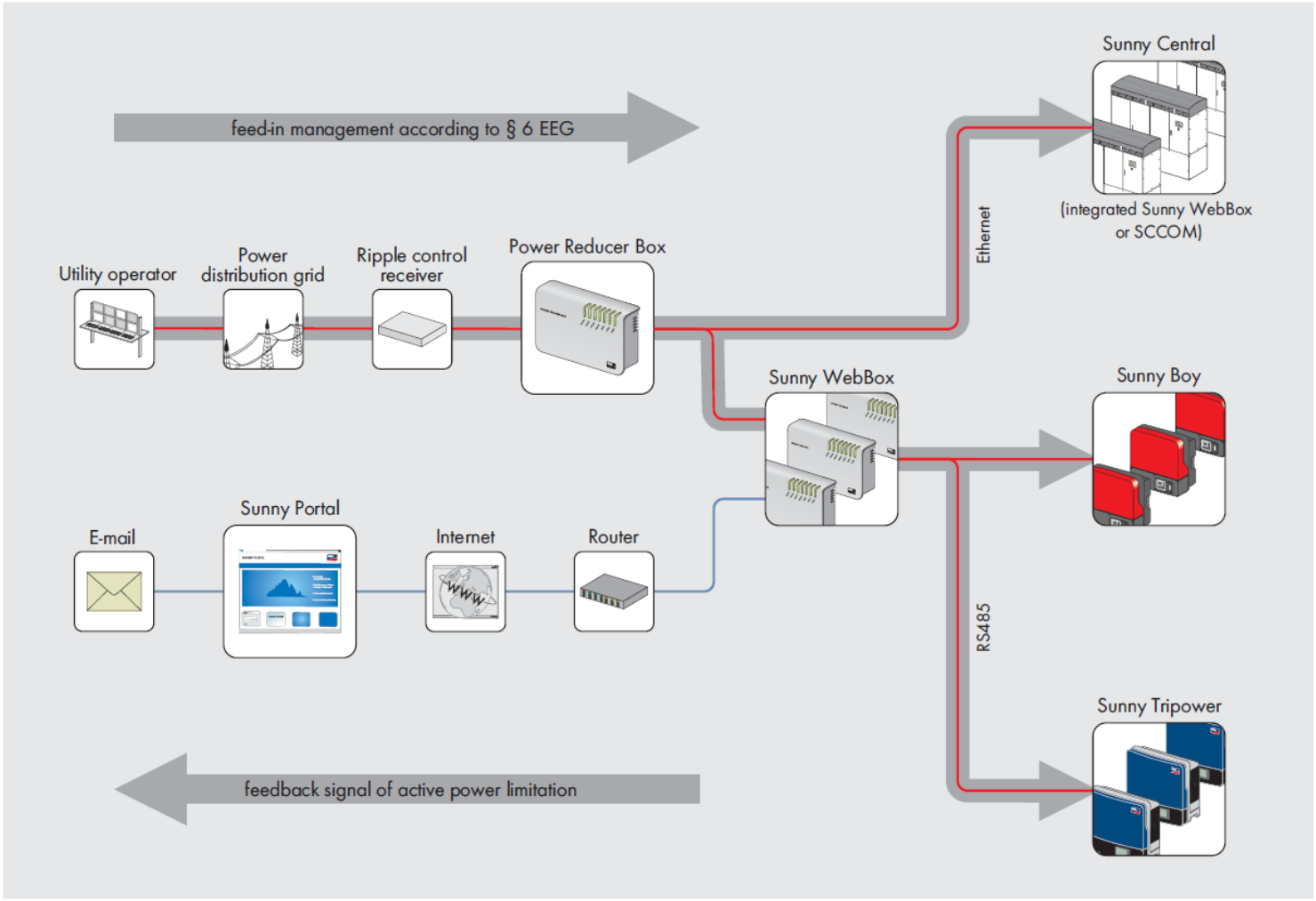
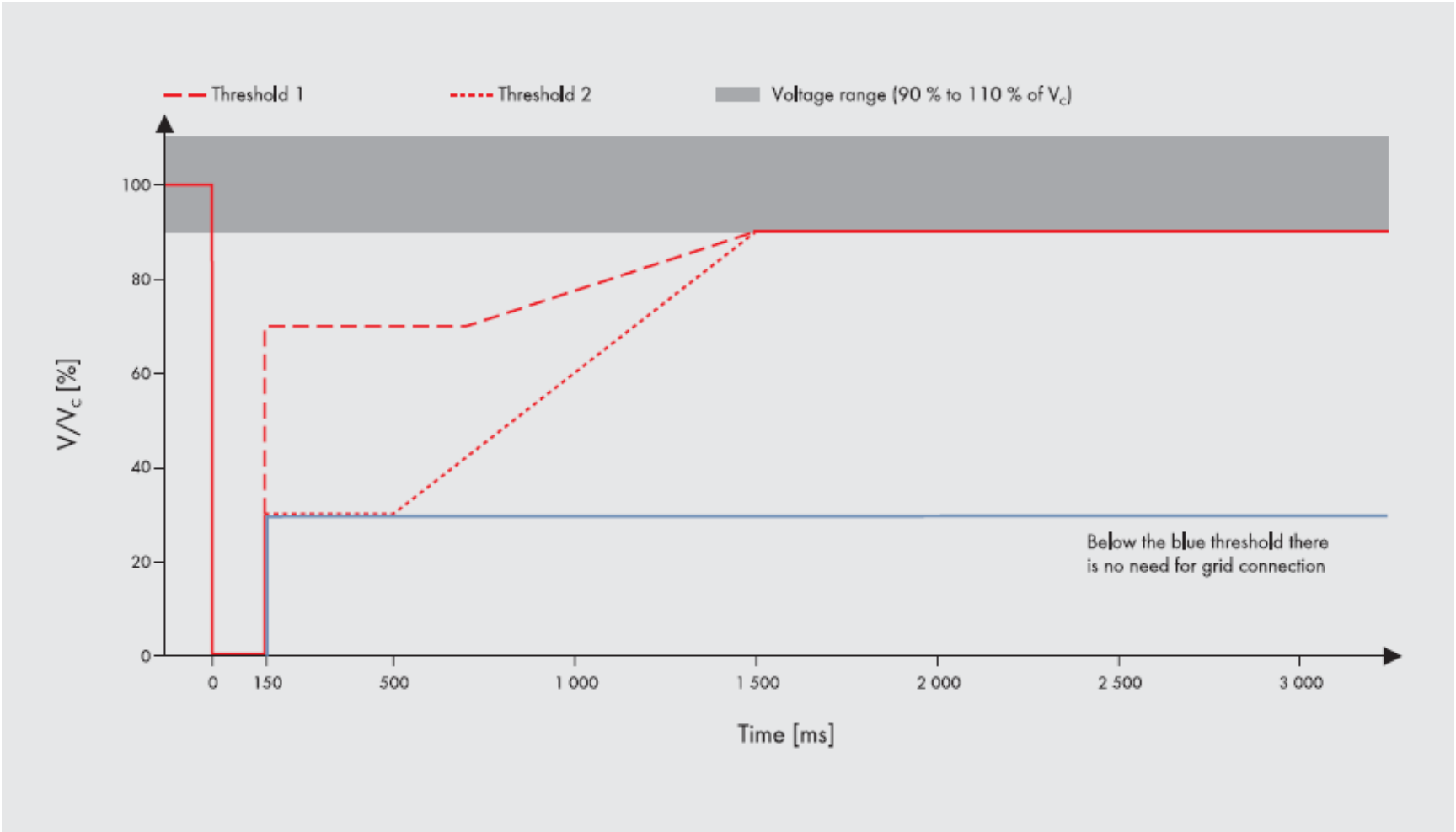


Picture: SMA Solar Technology AG

Dynamic grid support



Picture: SMA Solar Technology AG

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Smart homes

Over production

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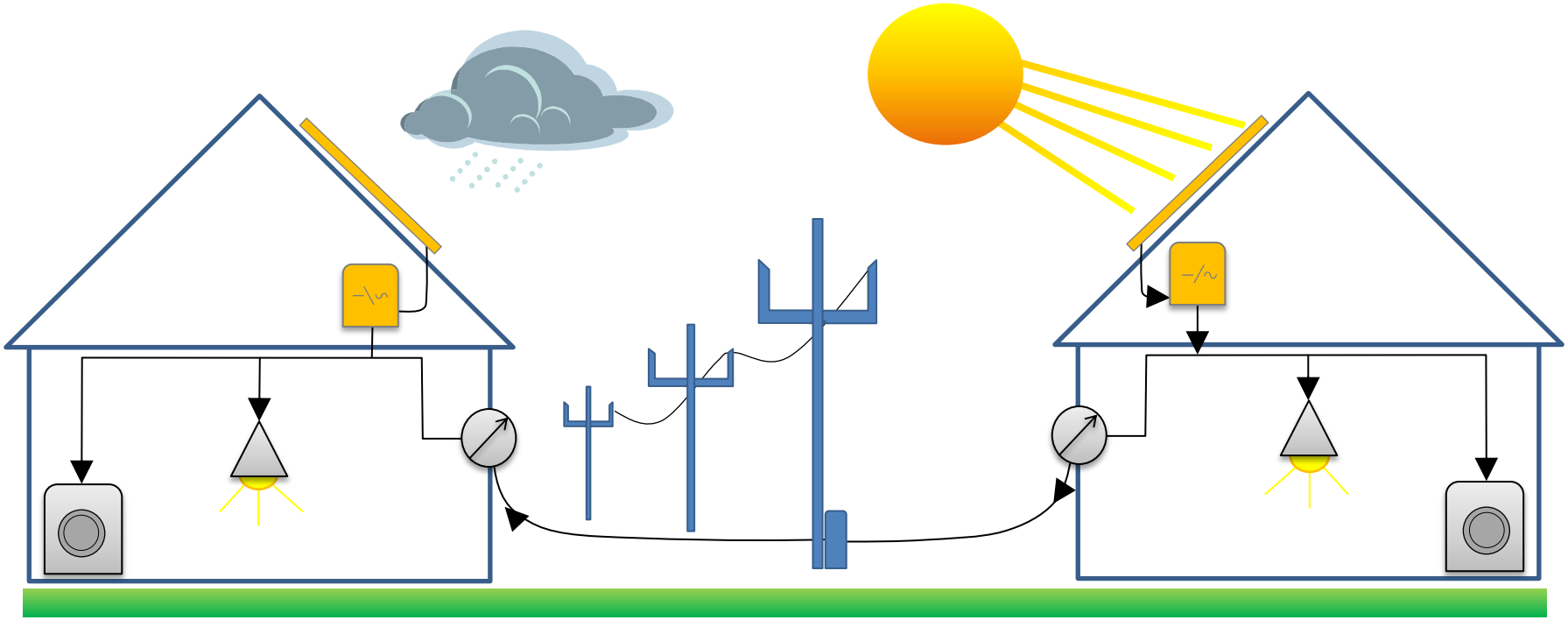
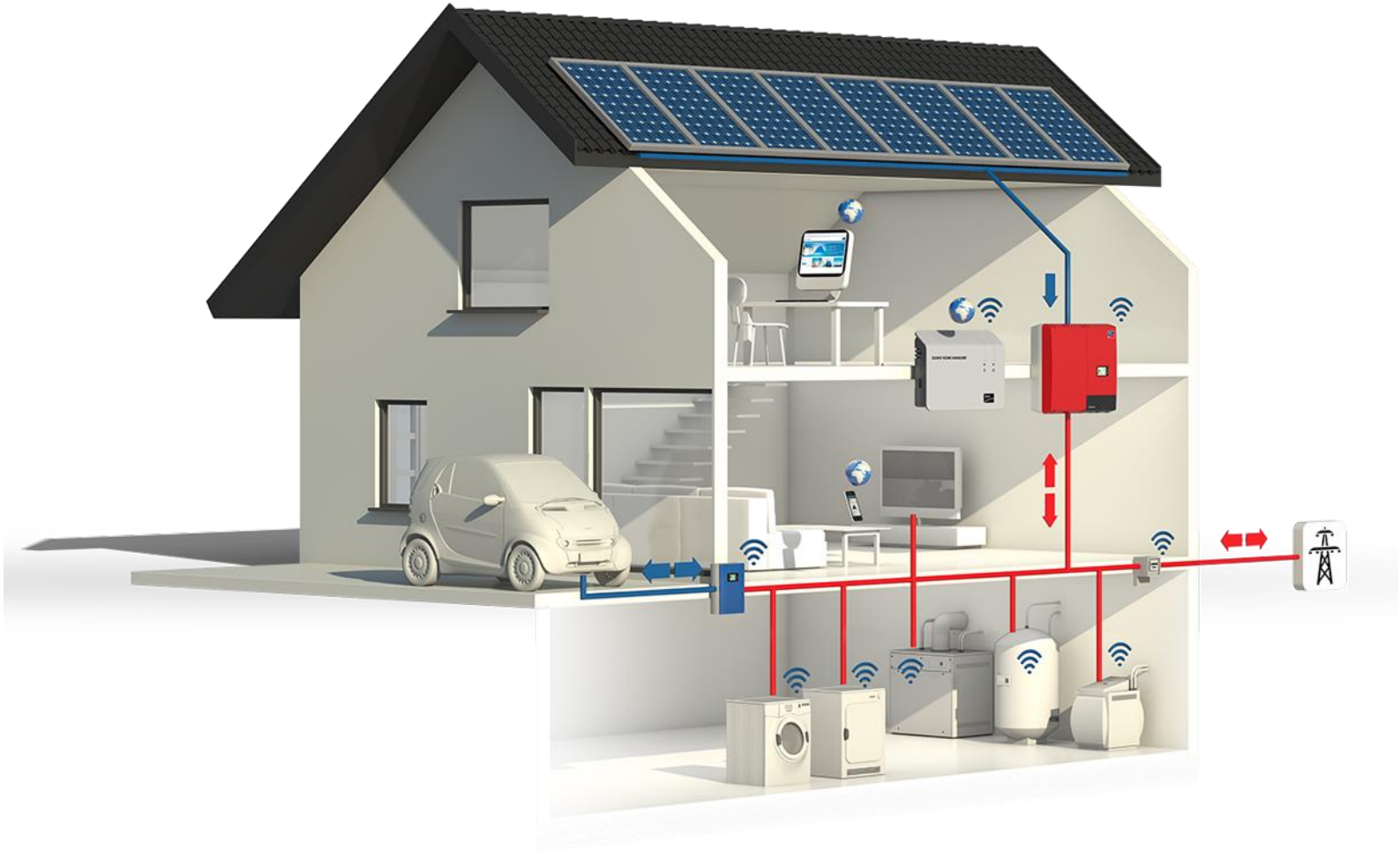


Smart home systems



Picture: SMA Solar Technology AG

Starting with simple solutions…

Picture: SMA Solar Technology AG

…to more advanced solutions

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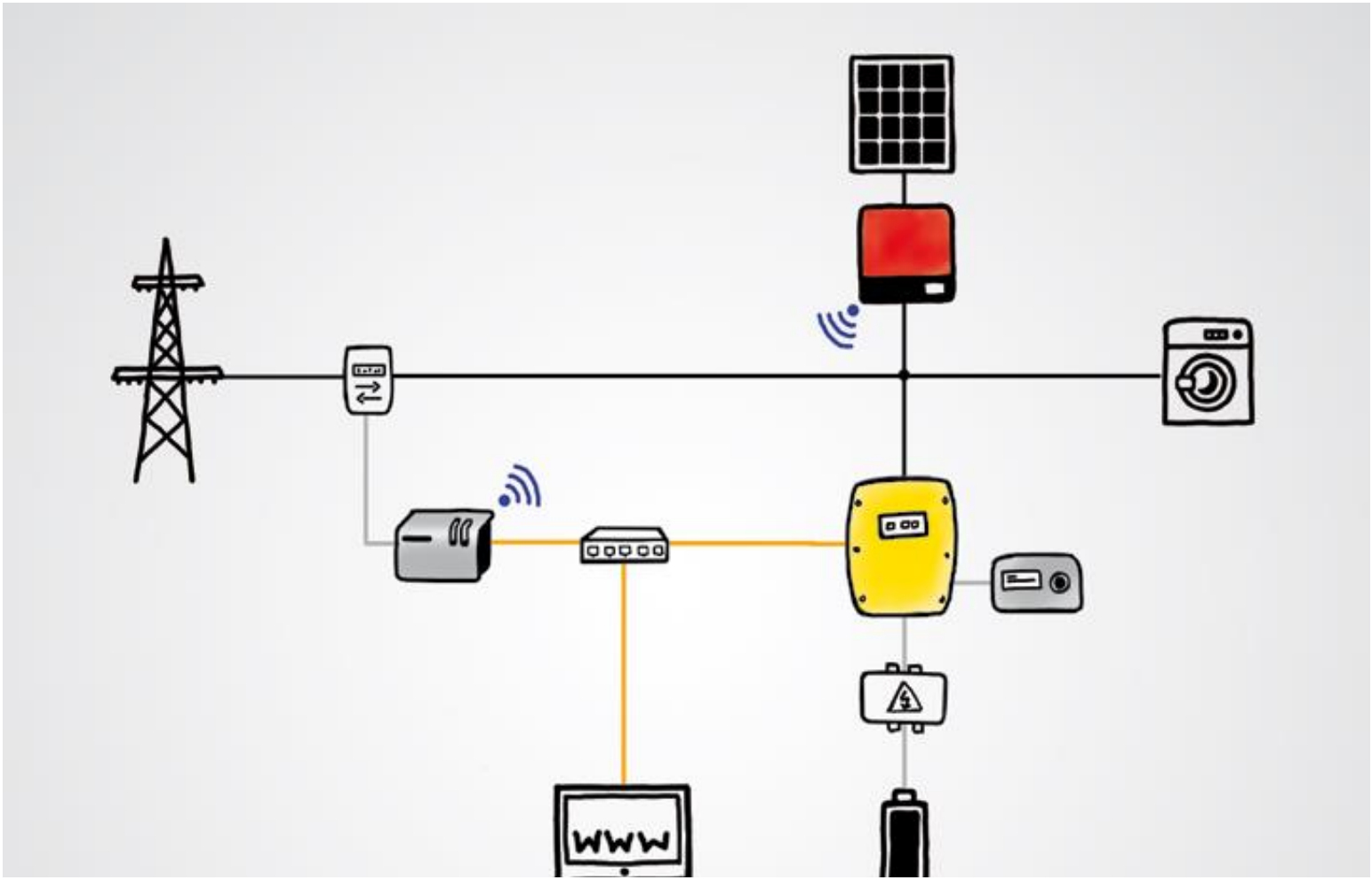

Picture: SMA Solar Technology AG

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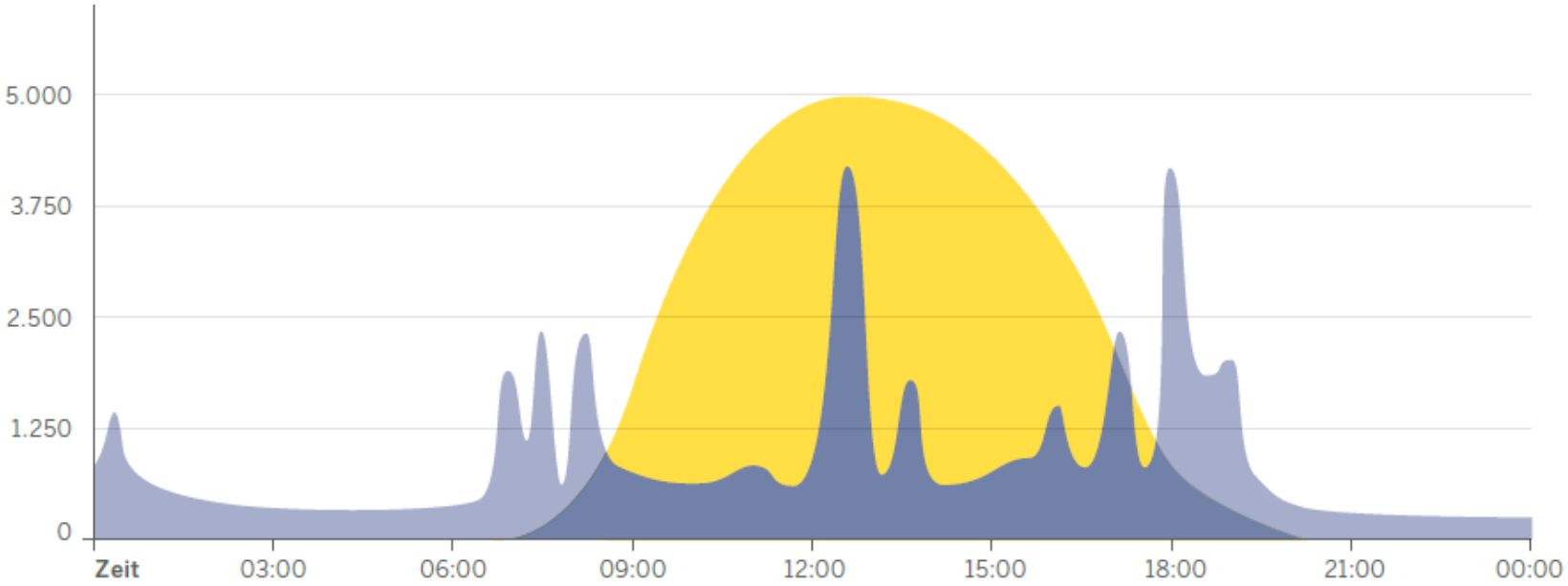

Picture: IBC Solar AG

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Picture: IBC Solar AG

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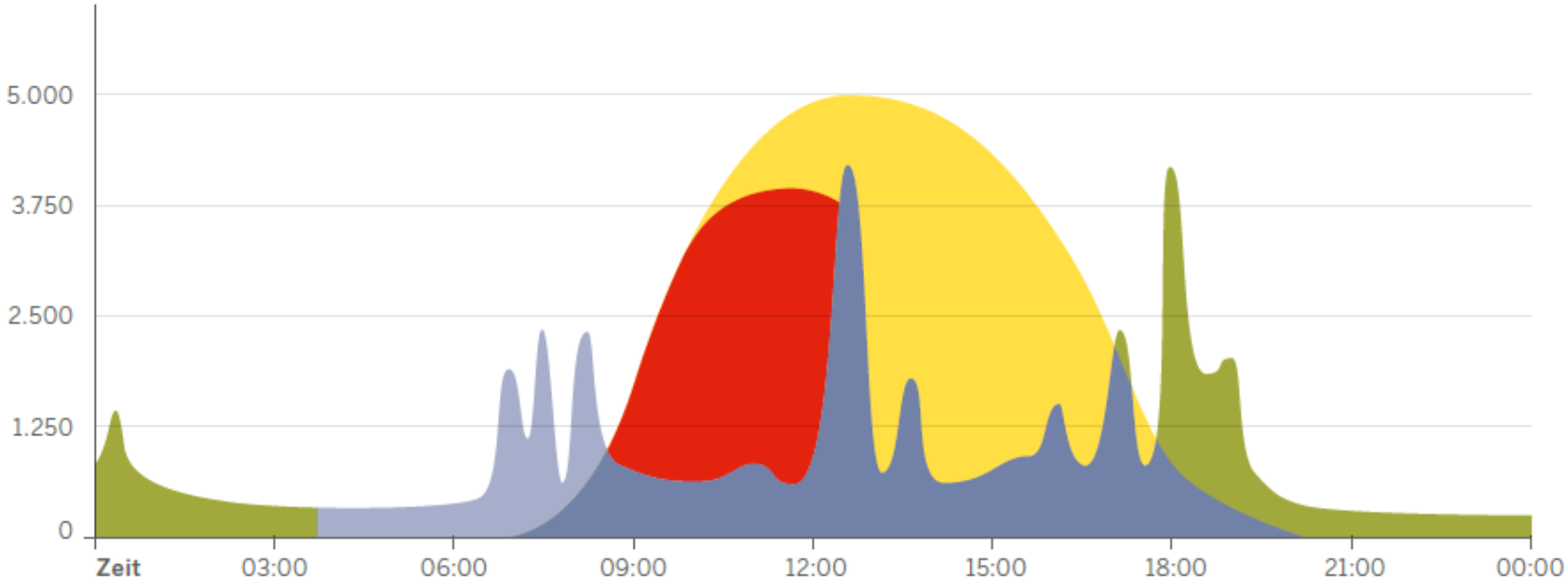

Picture: IBC Solar AG

Outlook: Interesting…

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Thank you!

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www.solkompaniet.se

Further reading

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- www.epia.org (European Photovoltaic Industry Association)
  - I.e. Global market outlook 2014-2018
- www.fraunhofer.de (German research institute)
  - I.e. ©Fraunhofer ISE: Photovoltaics Report (2014) Updated: 28 July 2014
- www.iea-pvps.org (International Energy Agency)
  - I.e. National survey reports of PV power (different countries)