PV Systems - Applications and Design

Grid-Connected PV Systems

Week 8.2

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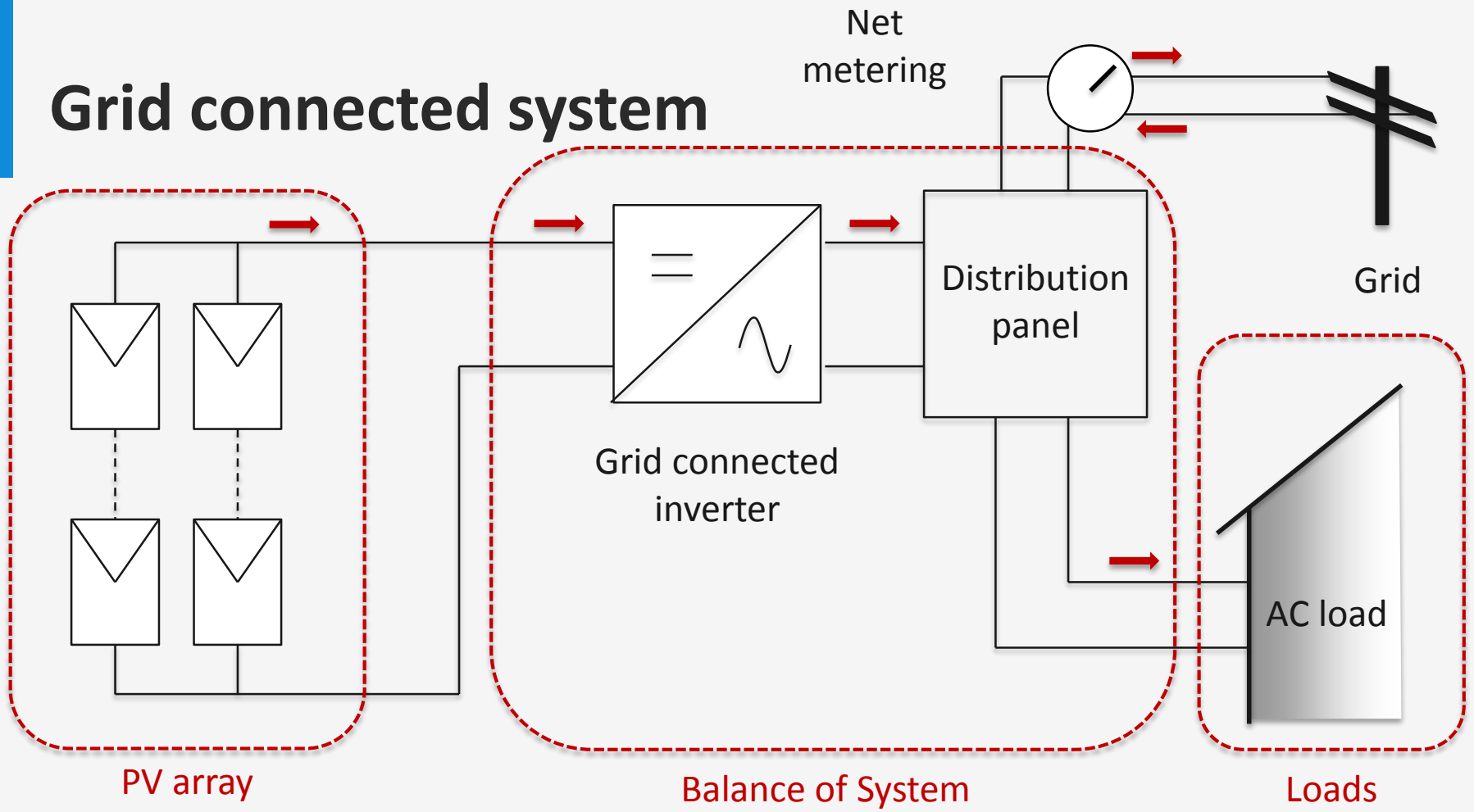
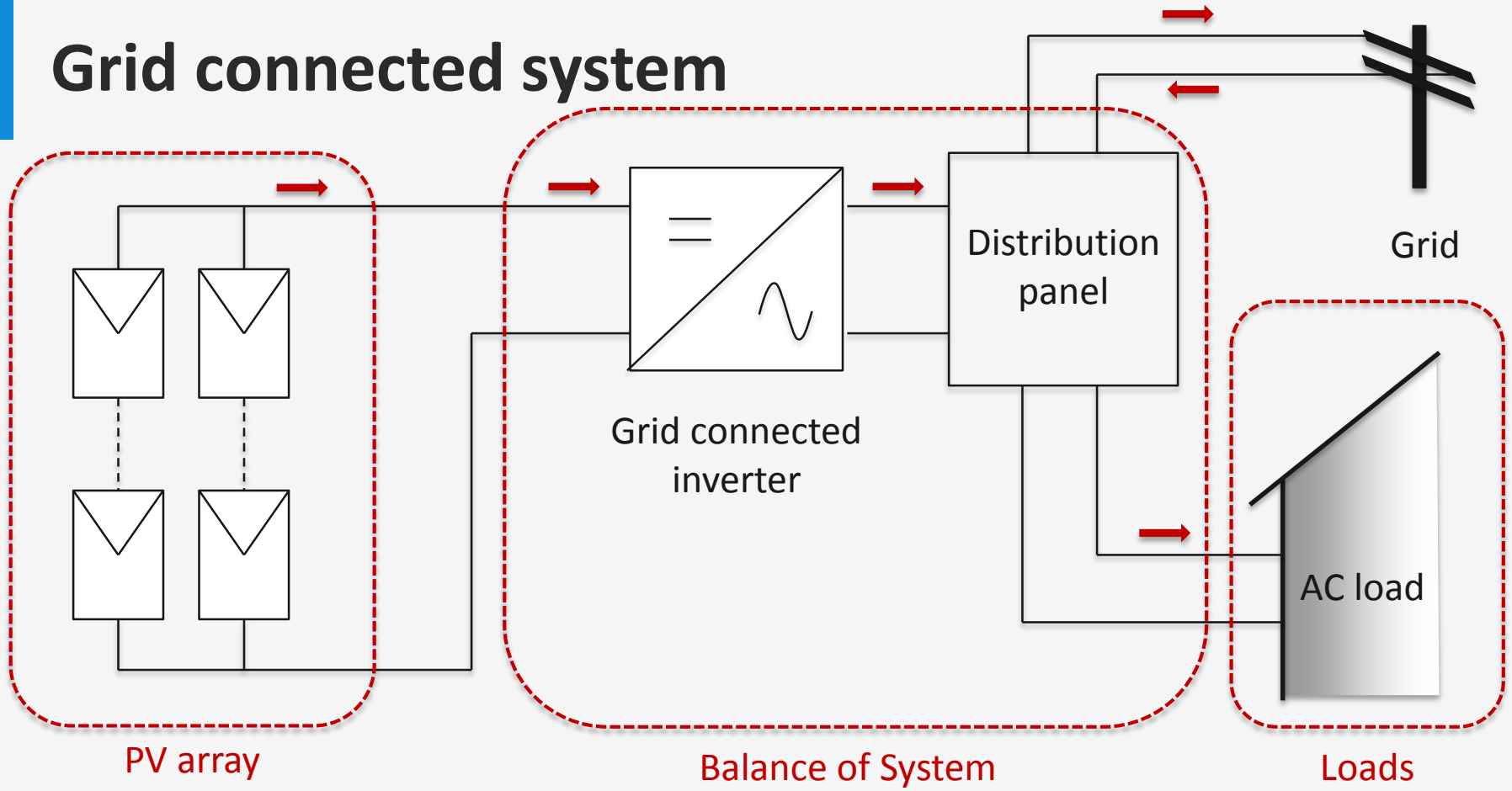
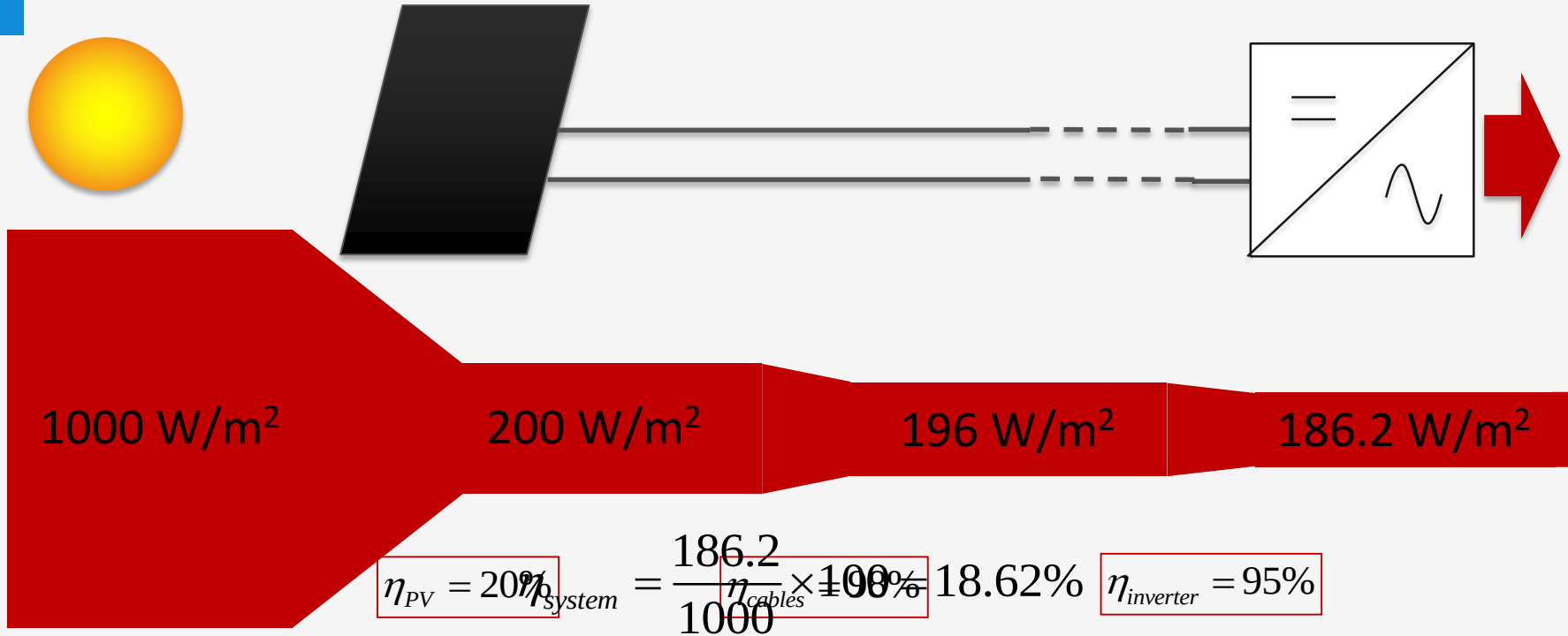
Grid connected system



Grid connected system



Grid connected system

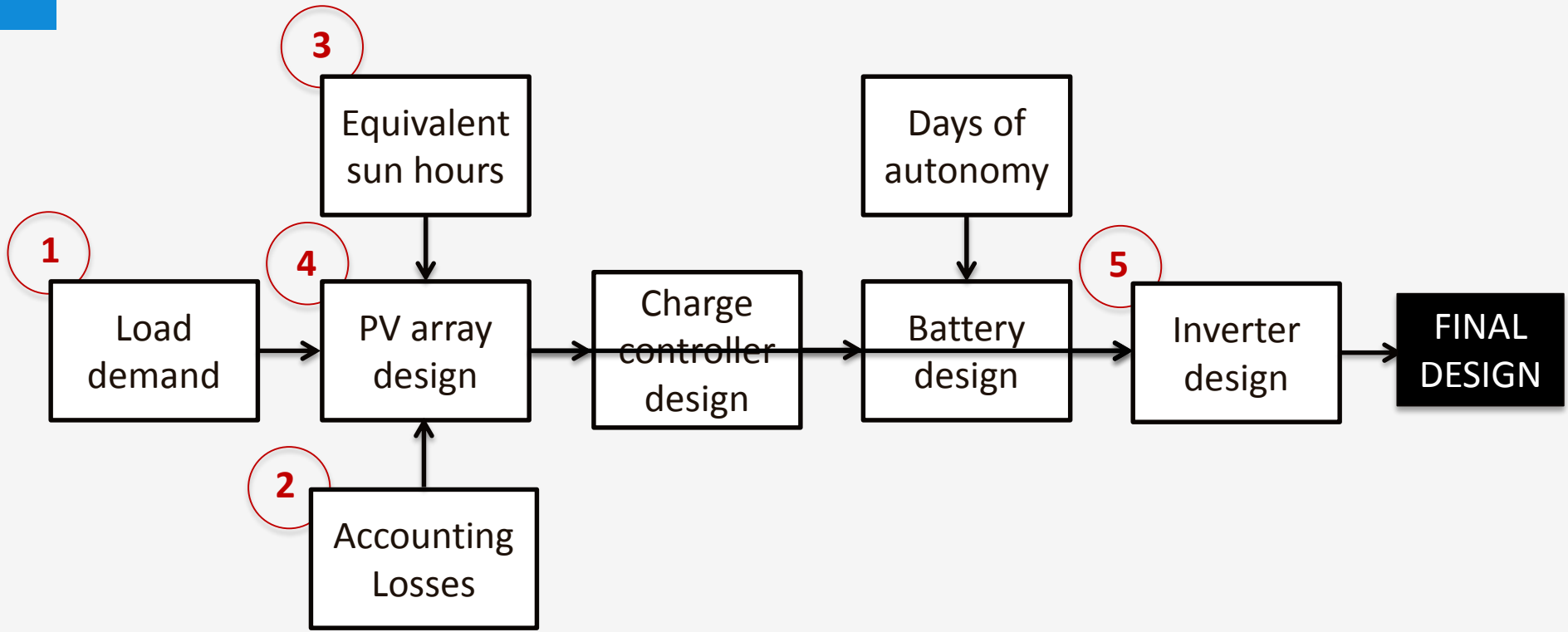


$\eta_{PV} = 20\%$ $\eta_{cables} = 98\%$ $\eta_{inverter} = 95\%$

$$\eta_{system} = \frac{186.2}{1000} \times 100\% = 18.62\%$$

$$\eta_{system} = \eta_{PV} \times \eta_{cable} \times \eta_{inverter}$$

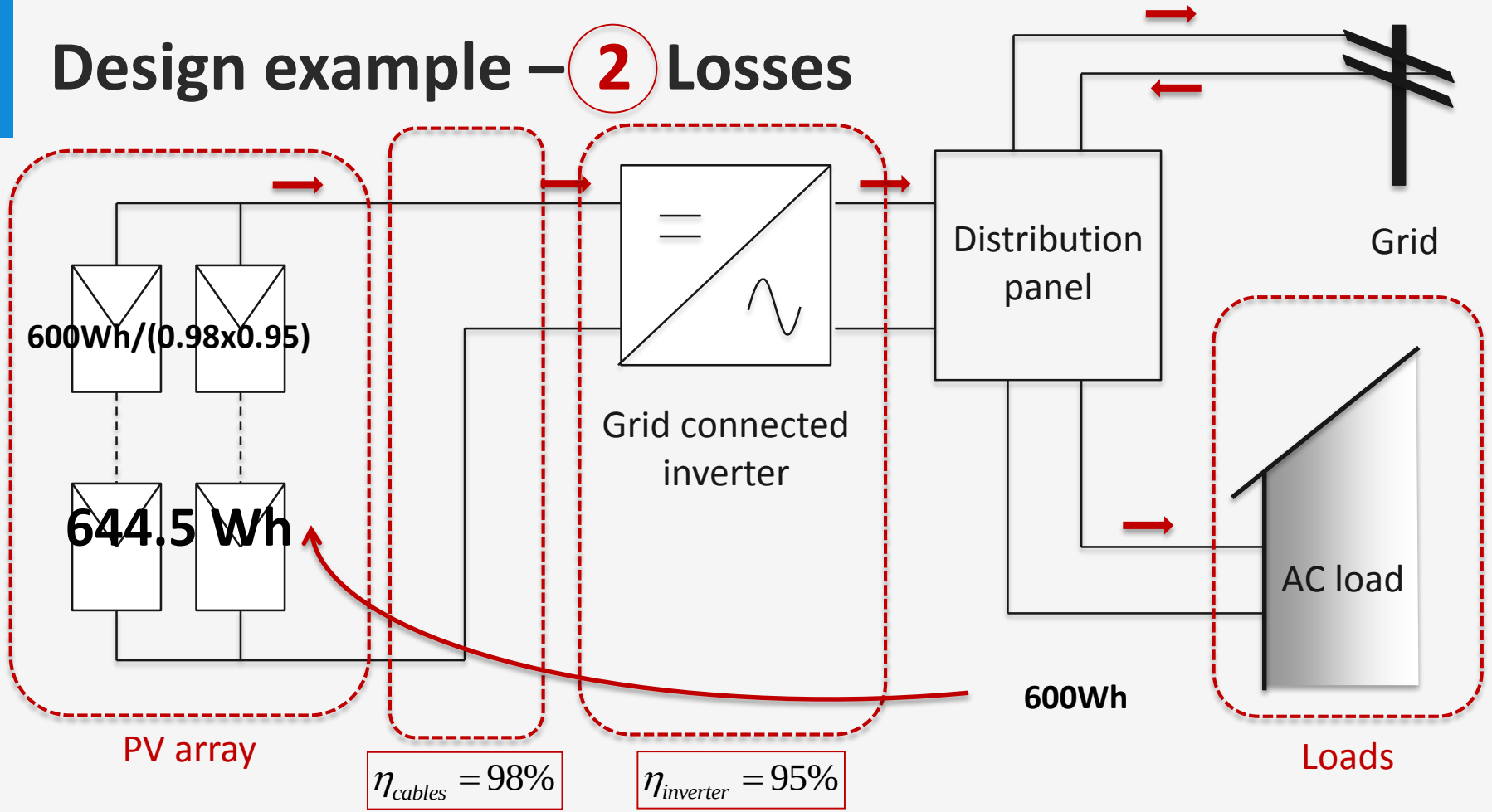
Design example



Design example – 1 Load demand

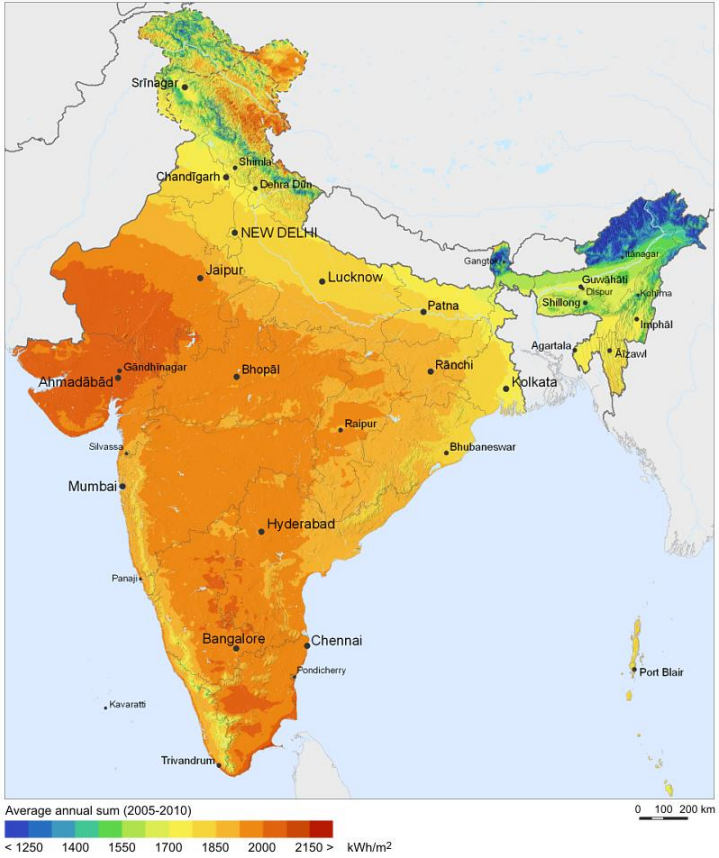
Item	Quantity	Power per item (W_{AC})	Total power (W_{AC})	Time of use (h)	Total energy (Wh)
Light	4	25	100	3	300
TV	1	100	100	2	200
Desktop	1	100	100	1	100
TOTAL			**300**		**600**

Design example – 2 Losses



Design example – 3 Insolation

Equivalent sun hours



~4.5 h/day

Design example – 4 PV array

Panel specifications(example)	
Power output (Wp)	100
V_{MPP} (V)	16
I_{MPP} (A)	6.25
V_{OC} (V)	20
I_{SC} (A)	7

?

Design example – 4 PV array

MPPT

Total energy demand

$$Minimum\,W_p = \frac{644.5Wh}{4.5h/day} = 143.2W$$

Equivalent sun hours

$$Number\ of\ \ panels = \frac{143.2W}{100W_p} = 1.4 \approx 2\,panels$$

Design example – 4 PV configuration

Parallel

Short circuit current

$$Maximum\,current\ I_{\max} = 7A \times 2 = 14A$$

Series

$$Maximum\,voltage\ V_{\max} = 20V \times 2 = 40V$$

Open circuit voltage

Design example – Grid connection

Design example – 5 Inverter

Power from one panel

$$\text{Minimum Nominal Power Rating} = 2 \times 100W = 200W$$

Inverter specifications(example)	
Rated power (W)	300
Maximum DC voltage (V)	50
Maximum DC current (A)	8
MPPT	Yes

$> V_{Max}$ panels

$< I_{Max}$

Panels in Series

Thank you for your attention!