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POWER ELECTRONICS GROUP

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Thoughts from a power electronics perspective

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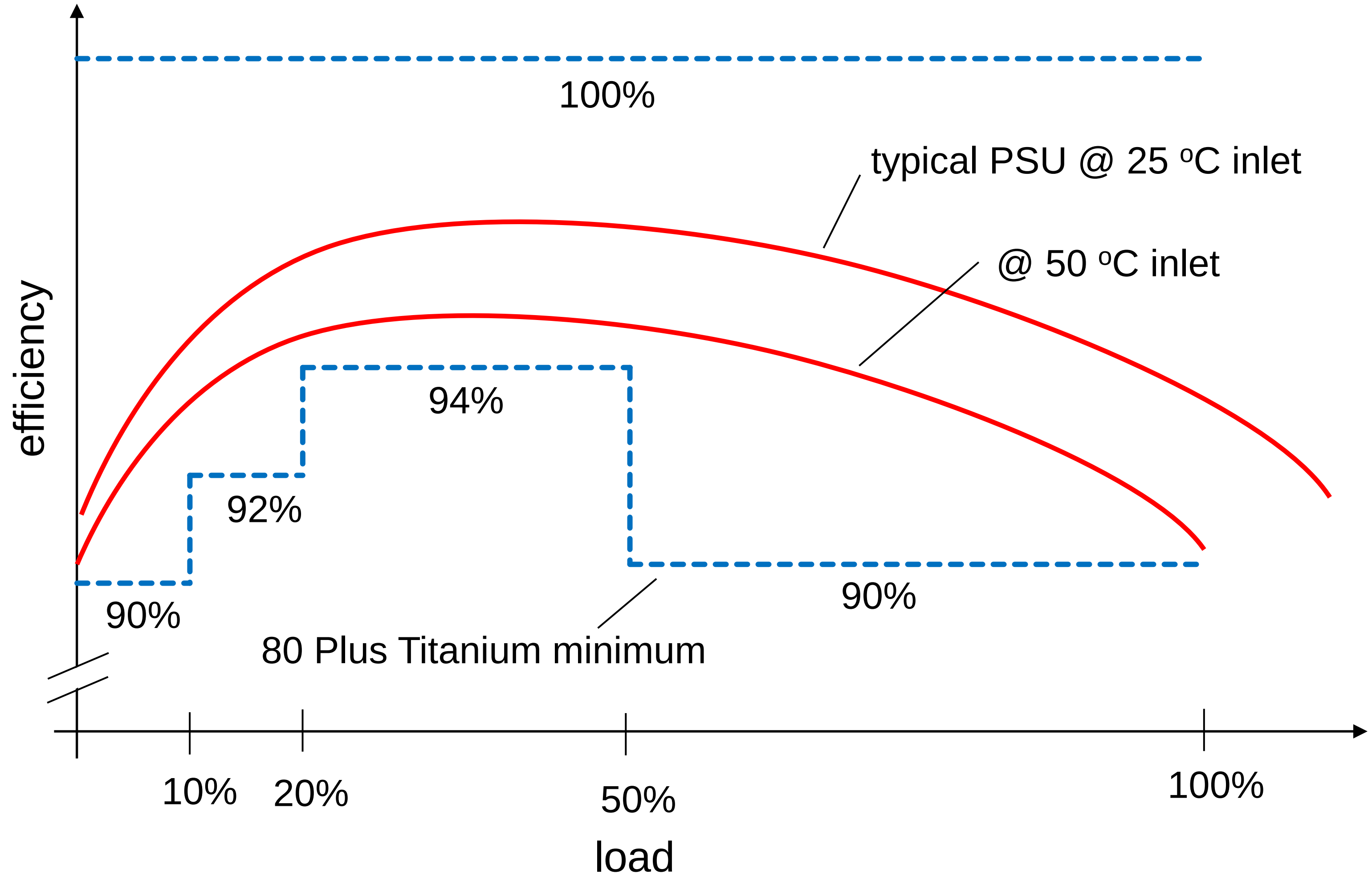
Carbon intensity is not constant

$$\frac{\mathrm{gCO_2}}{\mathrm{work}} = \frac{I}{C \times \eta_1 \eta_2 \eta_3 - H}$$



I: energy intensity $\left[\frac{\mathrm{gCO_2}}{\mathrm{kWh}}\right]$

C: “network efficiency” $\left[\frac{\text{stuff done}}{\mathrm{kWh}}\right]$

H: housekeeping expenditure $\left[\frac{\text{support effort}}{\mathrm{kWh}}\right]$

η_1, η_2, η_3 … : efficiency of power conversion stages [ ]

How well do we know $\eta_1 \eta_2 \eta_3$?

Doing metering in low-level hardware is hard

- Typical board-mount current sensors are only 2% accurate
  - Probably almost useless for measuring absolute real-time efficiency
  - There are more accurate sensors at higher levels, but then we lose granularity

- Could we characterise complete pieces of equipment for “compute efficiency” in a lab setting across multiple dimensions, then use lookup tables for real-time estimation?
  - How do we characterise workload? How many dimensions might be required?

- Could we use low-accuracy sensors to learn *relative* power consumption behaviour?
  - Lookup tables might provide a form of supervised learning for online estimation

- Has anyone tried to disaggregate sub-component consumption from higher-level aggregate measurements in complex computing systems?
  - Chip level
  - Motherboard level and higher