Science, my lad, is made up of mistakes, but they are mistakes which it is useful to make, because they lead little by little to the truth.

Jules Verne

Arizona State University
SES 194

Energy in Everyday Life

Photovoltaic II

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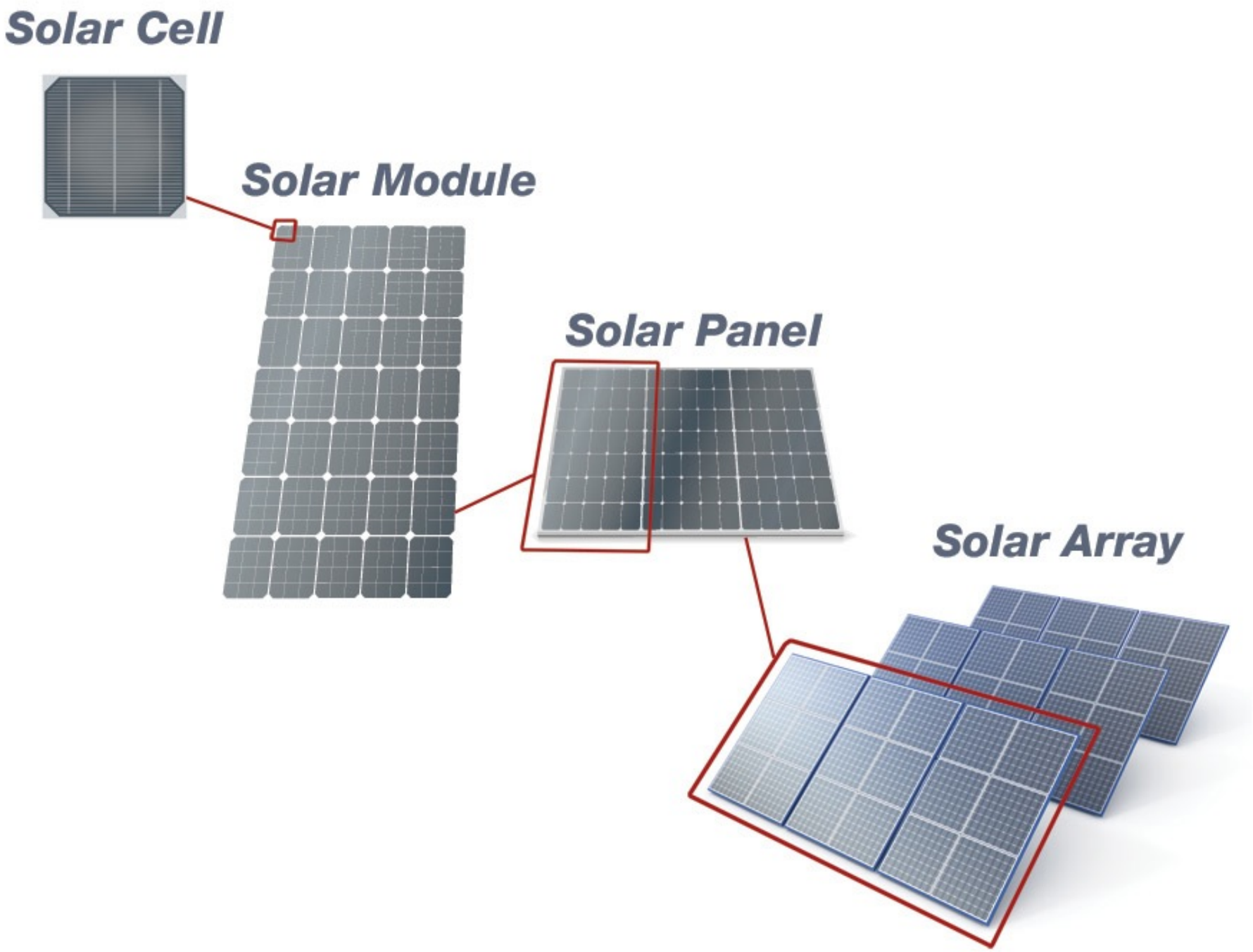
A single PV cell at full sun has a light to electricity efficiency of ~15% (good!) and acts like a battery with voltage ~0.6 V.

Cells are stack in series to get usefully high voltages. Higher voltage means delivering power with less current, meaning smaller wiring, and greater transmission efficiency.

A typical panel of 36 cells supplies ~16 V at max power, well suited for charging a nominal 12 V battery backup system.



Solar PV is usually priced in dollars per peak Watt, that is, how fast can it produce electrical energy.

Panels cost ~$5/Watt installed, so a 5kW home system is ~$25,000 without rebates.

Payback occurs in ~10 years, “free” electricity afterwards.

The sun is not always up or shining brightly.

A civilization that expects energy availability at all times is thus not fully compatible with solar power only.

Large-scale solar implementation must confront then energy storage techniques to be more useful.

Current storage methods:
lead-acid batteries - conventional, cheapest option
exotic batteries - need development
hydrogen fuel - could power fleet of cars, but inefficient
global electricity grid - its always sunny somewhere
pumped water storage - not much capacity

Current biggest PV installations (nominal power)
590 MW, Charanka Solar Park India
550 MW, Topaz Solar Farm, California
320 MW, Longyangxia Dam Solar Park, China
290 MW, Agua Caliente Solar Project, Arizona