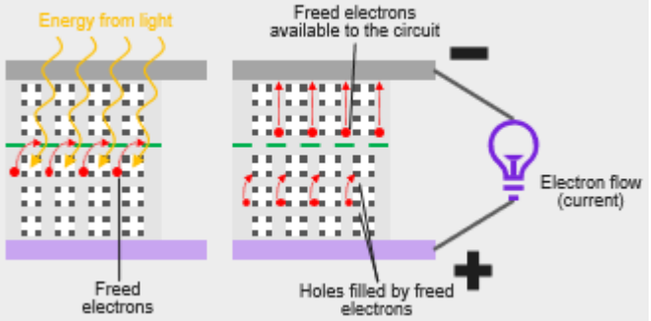
KEARNEY | Energy Transition Institute

What is solar photovoltaic (PV)?

Is the electrical conversion of sunlight using the photovoltaic effect of cells.

Solar cells are made of doped semiconductors (n or p-type), this forms an electrical field between the semiconductors.

When light meets a solar cell, photons transfer their energy to electrons. These electrons move and create an electrical current thanks to the electrical field.



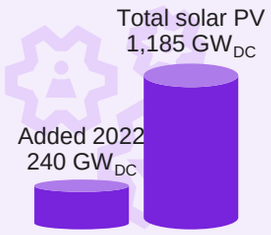
– Policies have supported PV deployment, feed-in tariffs and net metering are widespread.
– Direct sale of PV electricity through PPAs is growing, driven by corporations having pledged for cleaner operations.

PV GHG footprint is among the highest among low-carbon technologies. Half of GHG emissions come from silicon production.

Market status

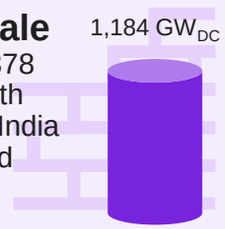
Operating

China is leading with 44% of new additions, followed by EU27.



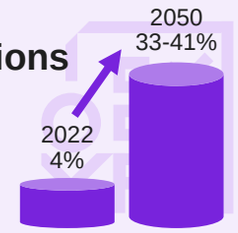
Upcoming utility-scale

China alone plans to add 378 GW, followed by the US with 115 GW. Australia, Brazil, India and Spain also plan to build more than 50 GW each.



Long-term projections

Solar PV is expected to supply between 33 and 41% of global electricity need by 2050.



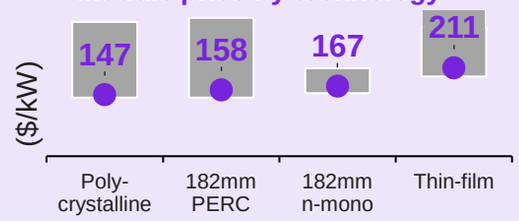
Cell technologies

Monocrystalline silicon is the dominant technology.
– Mono PERC (p-type)
– TOPCon
– Mono PERC (n-type)
– HJT

Thin film technologies have remained stable, representing few points of the market share (CdTe ~3.5%, CIGS/CIS ~0%)

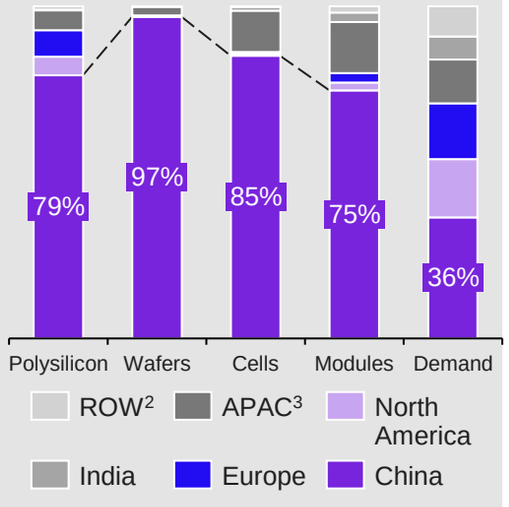
Module prices vary by technology, with thin-film 44% more expensive per kW than polycrystalline modules.

Module price by technology



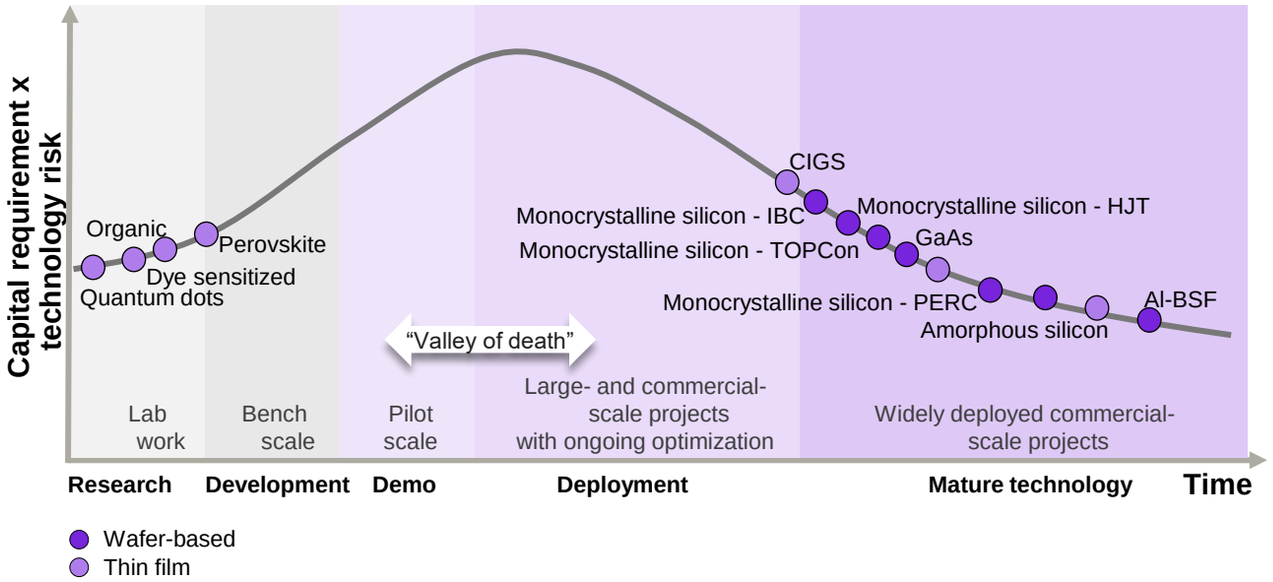
Value chain

Value chain is concentrated in China while demand spreads between markets.



Global manufacturing capacity was 391 GW in 2021 and 450 GW were under construction.

Technology maturity curve



PV systems

On-grid

Utility scale
BIPV
PV shading
Agrivoltaics
Floating PV

More than 99% of current capacities are on-grid installations

Off-grid

Standalone
Mini-grid