

Green Innovation Starts Here:

Menjelajah Karier di
Bidang AgriPV dan
Energi Terbarukan

Driving the Future

Dr. Eng. Tika Erna Putri



BIODATA



TIKA ERNA PUTRI



- Wonosobo, Jawa Tengah
- Sleman, Yogyakarta, ID



- Bachelor : UNNES
- Master : UGM (Scholarship)
- Doctoral : Kyushu University (scholarship)



- Full-time lecturer - researcher
(Dept of Electrical Engineering and Informatics,
Vocational College, Universitas Gadjah Mada)



- tika.erna.p@ugm.ac.id
- tikaernaputri@gmail.com



- Reading → novel (fantasy, romance, life), book (motivation, self building)
- Travelling
- Watching netflix

UPDATE HARGA BBM PERTAMINA 10 JUNI 2026

Pertamina Patra Niaga mengumumkan kenaikan harga produk bahan bakar minyak jenis Pertamax mulai Rabu (10/6/2026).

JENIS BBM	HARGA BARU (PER LITER)
PERTALITE (RON 90)	Rp10.000
PERTAMAX (RON 92)	Rp16.250
PERTAMAX GREEN (RON 95)	Rp17.000
PERTAMAX TURBO (RON 98)	Rp20.750
DEXLITE (CN 51)	Rp23.000
PERTAMINA DEX (CN 53)	Rp24.800
BIOSOLAR	Rp6.800

"Penyesuaian harga Pertamax dan Pertamax Green dilakukan setelah melalui proses evaluasi sesuai formula harga yang ditetapkan pemerintah,"

Roberth MV Dumatubun
Sekretaris Perusahaan Pertamina Patra Niaga

SUMBER: REPUBLIKA.CO.ID | PENGOLAH: FRISKA YOLANDHA
FOTO: DOK PERTAMINA | INFOGRAFIS: ALI IMRON



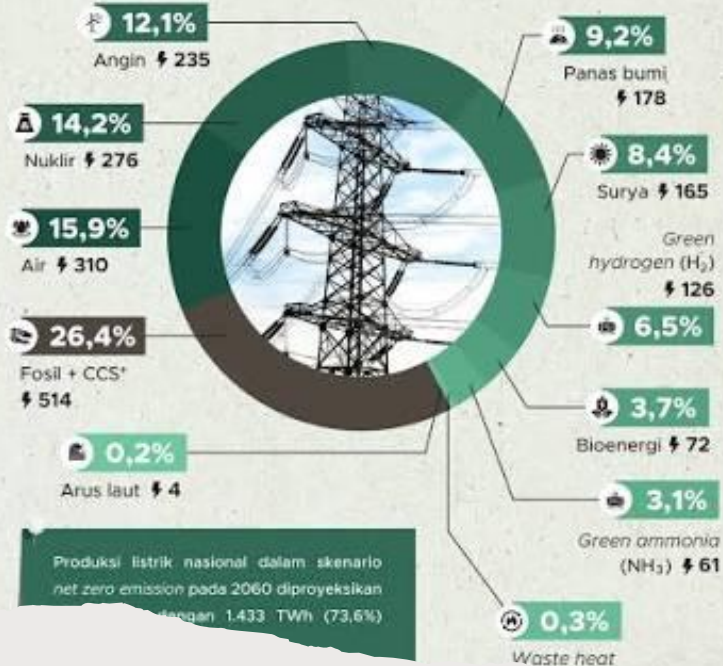
PETANI PUNK SUPLAI MBG

"PETANI PUNK" MERUPAKAN ANAK MUDA YA TIDAK TERGIUR KERJA FORMAL DI KOTA, TETAPI MEMILIH GERAKKAN PERTANIAN DAN MERANGKUL GEN Z DI DESA. MEREKA KINI SI SUPLAI 5 DAPUR MBG DI AKHIR APRIL INI.

Para pemuda itu mengintegrasikan teknologi AI untuk memastikan kualitas bahan baku tetap terjaga serta mengawasi kelancaran rantai pasok dari hulu hingga ke tangan penerima manfaat

Bauran Produksi Listrik RI 2060, 73% dari EBT

Based on Rencana Umum Ketenagalistrikan Nasional 2025-2060



PEMERINTAH TETAPKAN RUKN 2060

KEPMEN ESDM NO. 85.K/TL.01/MEM.L/2025

Begini Proyeksi Kebutuhan Listrik
di Masa Depan!



Koperasi Merah Putih Buka Jalan Energi Bersih Desa



Koperasi Desa Merah Putih dinilai berpotensi menjadi penggerak energi baru terbarukan di tingkat desa.



Jaringan koperasi yang luas bisa dimanfaatkan untuk membangun ekosistem energi berbasis masyarakat.



Desa tidak hanya menjadi konsumen energi, tetapi ikut mengelola potensi energi lokal.

Manfaat untuk Desa



Energi bersih untuk kehidupan yang lebih baik



Hemat biaya, tingkatkan kemandirian desa



Ciptakan lapangan kerja dan peluang usaha baru



Perputaran ekonomi desa semakin kuat

Kebijakan yang Terlupakan

MACAM-MACAM ENERGI TERBARUKAN



SURYA



ANGIN



GEOTERMAL



HIDRO

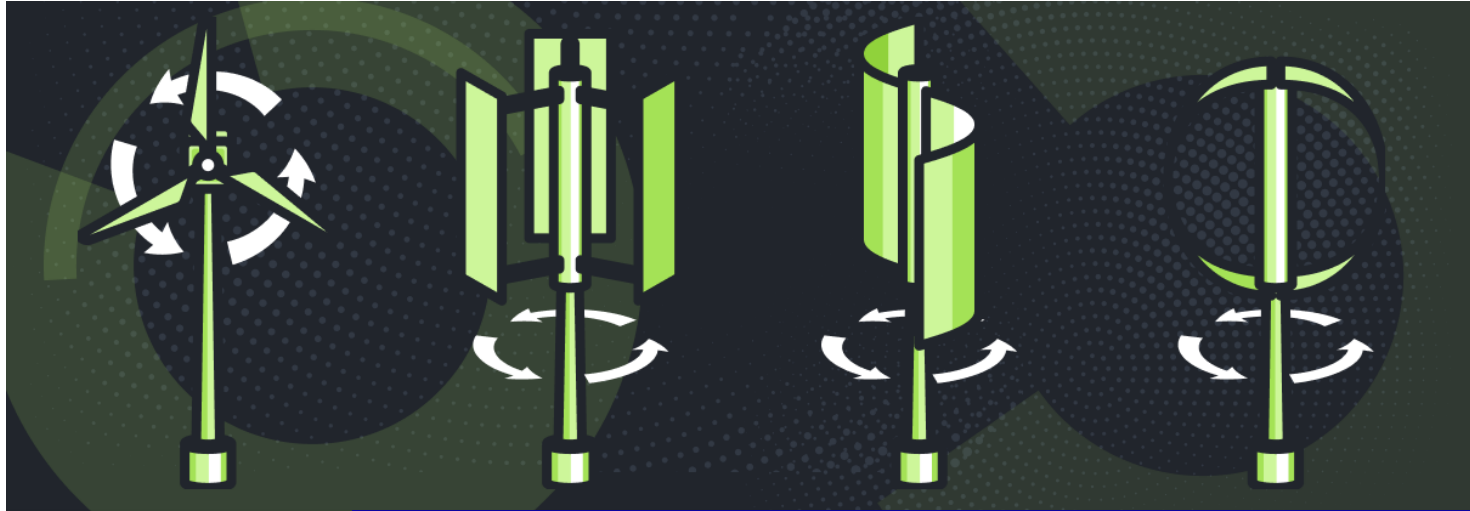


BIOMASSA

Energi Angin

Desain wind turbin sekarang ini: *Low speed wind Turbin*

Arah angin Omnidirectional, cocok diperkotaan



VERTICAL AXIS WIND TURBINES



Darrieus



Helical



H Rotor



Savonius



Mudah didapat di platform lokal

☐ Star

Metode Pembayaran

☐ COD (Bayar di Tempat)

Opsi Pengiriman

☐ Same Day

☐ Reguler

☐ Hemat Kargo

☐ Next Day

Lainnya ▾

Program Promo

☐ Promo XTRA+

☐ Promo XTRA

☐ SPayLater 0%

☐ Bebas Pengembalian

Lainnya ▾

Batas Harga

Rp MIN

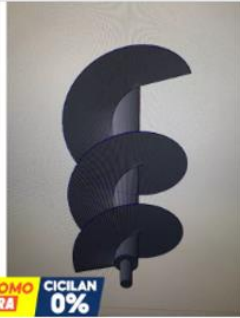
—

Rp MAKS

Rp3.486.696

★ 5.0

Kab. Semarang



PROMO XTRA CICILAN 0%

Star Paket Custom turbin Archimedes dan Turbin...

Rp 500.000

Beli Banyak Lebih Hemat

Kab. Majalengka

Rp31.000 -6%

Pilih Lokal

★ 4.8

Kab. Boyolali



MADANI JAYA STORE

Vertical Axis Wind Turbine VAWT Turbin Angin 500-...

Rp5.800.000

Jakarta Barat

Rp3.466.696 -1%

★ 4.6

Kab. Semarang



Edukasi Sain & Teknologi Wind Turbin Generator

Paket Hemat

PROMO XTRA

KMG-001 KIT DIY Merangkai Wind Turbine...

Rp37.500

★ 4.8

Jakarta Timur

Rp3.600.000

Jakarta Barat



PROMO XTRA

Star+ Turbin Angin VAWT Vertical Axis Wind Turbine...

Rp8.500.000

Kab. Bekasi

Rp3.529.950

Kab. Semarang



ISO PELITA JAYA GLODOK

READY STOCK

PROMO XTRA CICILAN 0%

Vertical Axis Wind Turbine VAWT Turbin Angin 3000-...

Rp7.000.000

★ 5.0

Jakarta Barat



PROMO XTRA CICILAN 0%

Vertical Axis Wind Turbine VAWT Turbin Angin 500-...

Rp7.000.000

Jakarta Barat



PROMO XTRA CICILAN 0%

Star Turbin Angin Blade - Wind Turbine - Kincir Angi...

Rp80.000

★ 5.0

Kab. Majalengka



PROMO XTRA

Wind Turbin 500W 1000W 1500W 2000W Low Wind...

Rp5.269.400 -2%

Kab. Magetan



PROMO XTRA

Vertical Wind Generator 1000W

12V/24V/48V

FREE Charger Controller

Wind Turbine Generator 1000W- free ongkir - 1000...

Rp5.450.000

Tangerang Selatan



PUTRA TUNGGAL PERKASA Authorized Distributor ISO RoHS CE

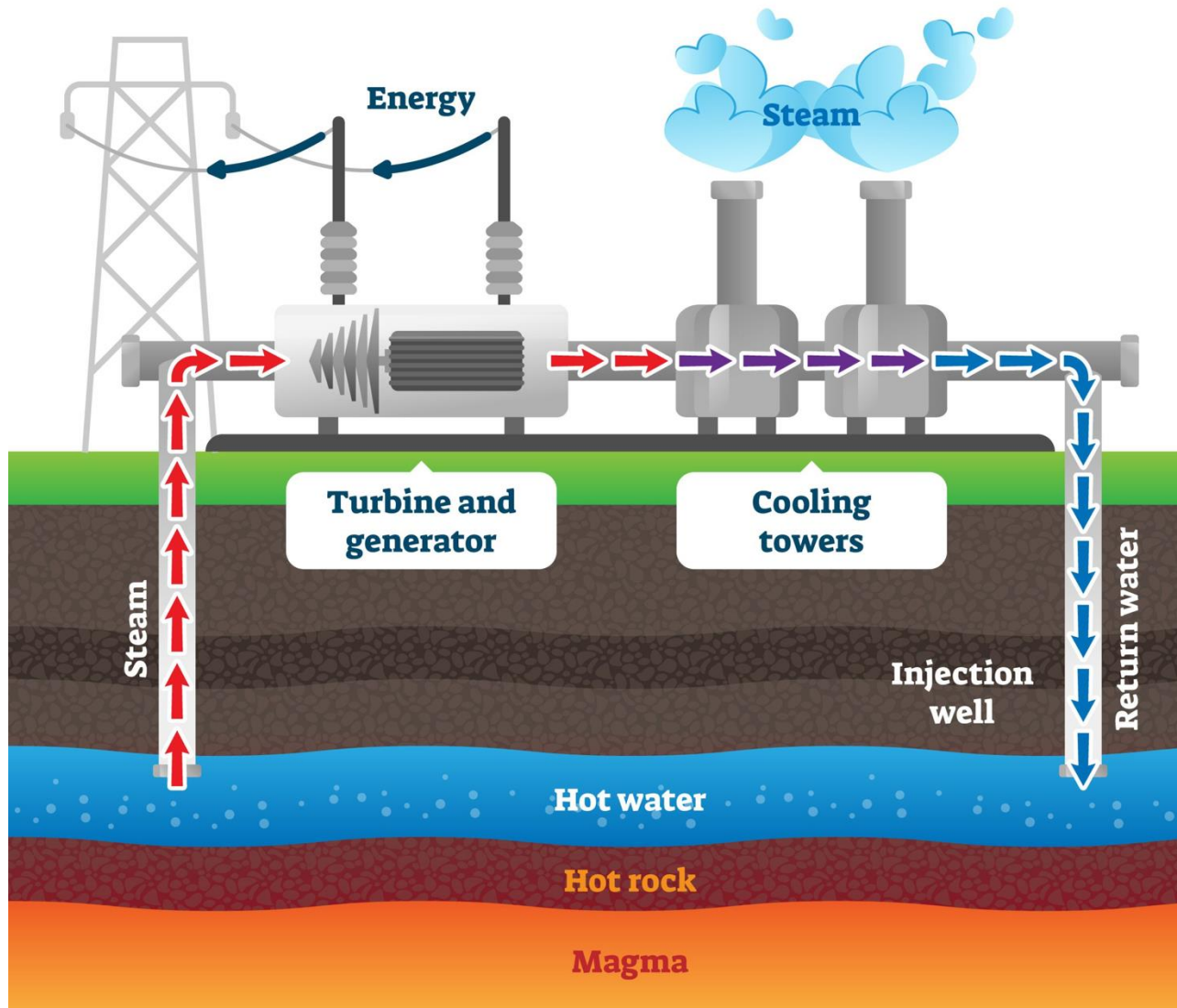
Vertical Axis Wind Turbine VAWT Turbin Angin 3000-...

Rp7.000.000

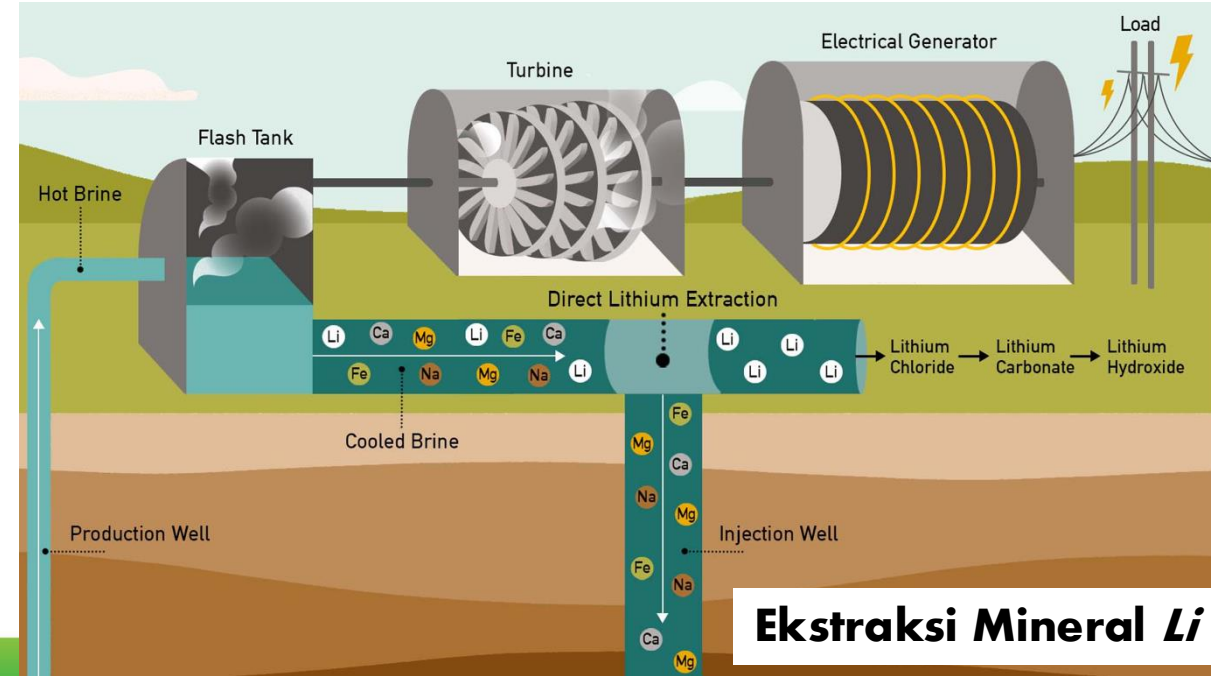
★ 5.0

Jakarta Barat

GEO THERMAL ENERGY



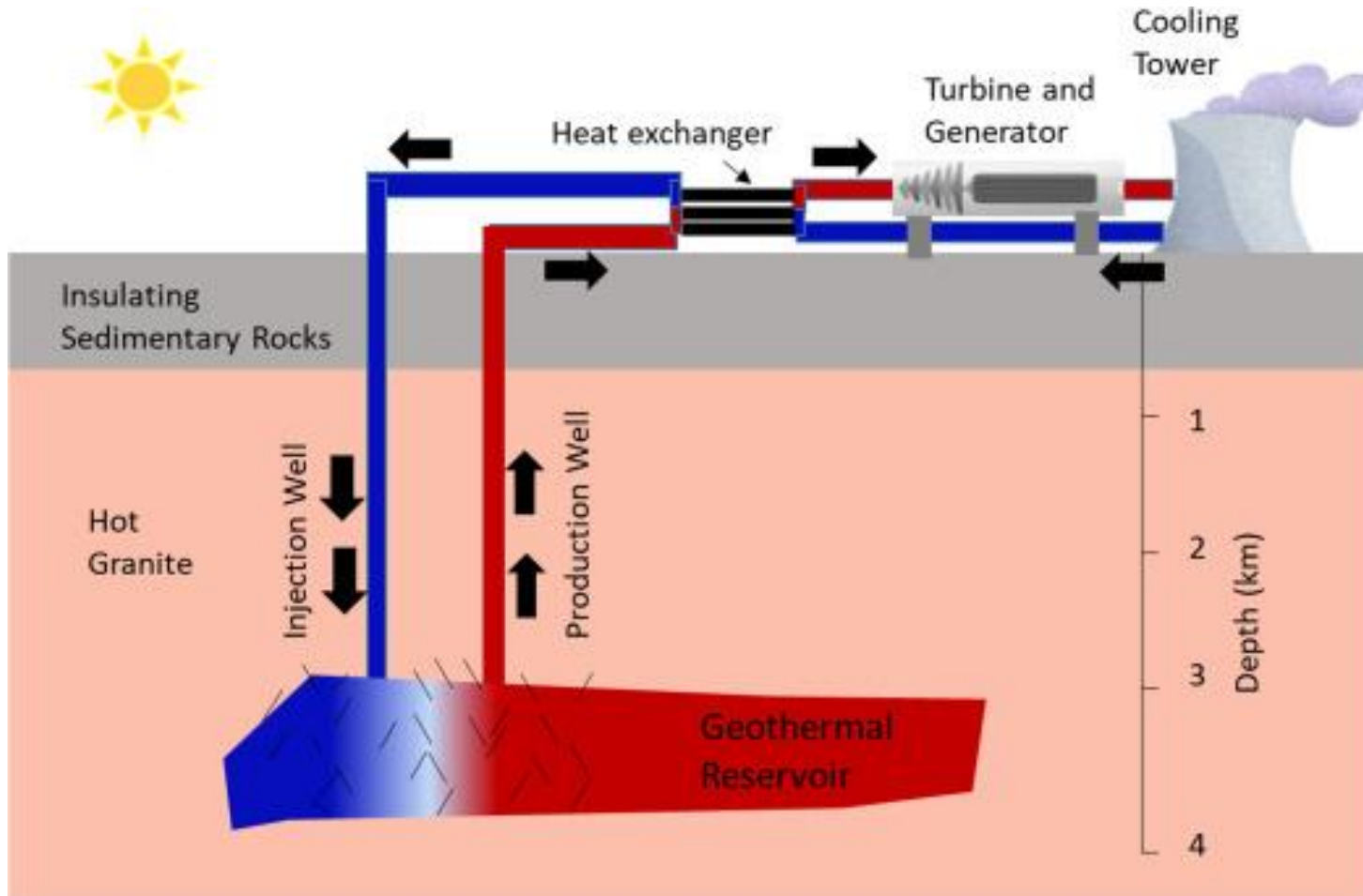
Apa yang "Hit" sekarang di Geothermal?



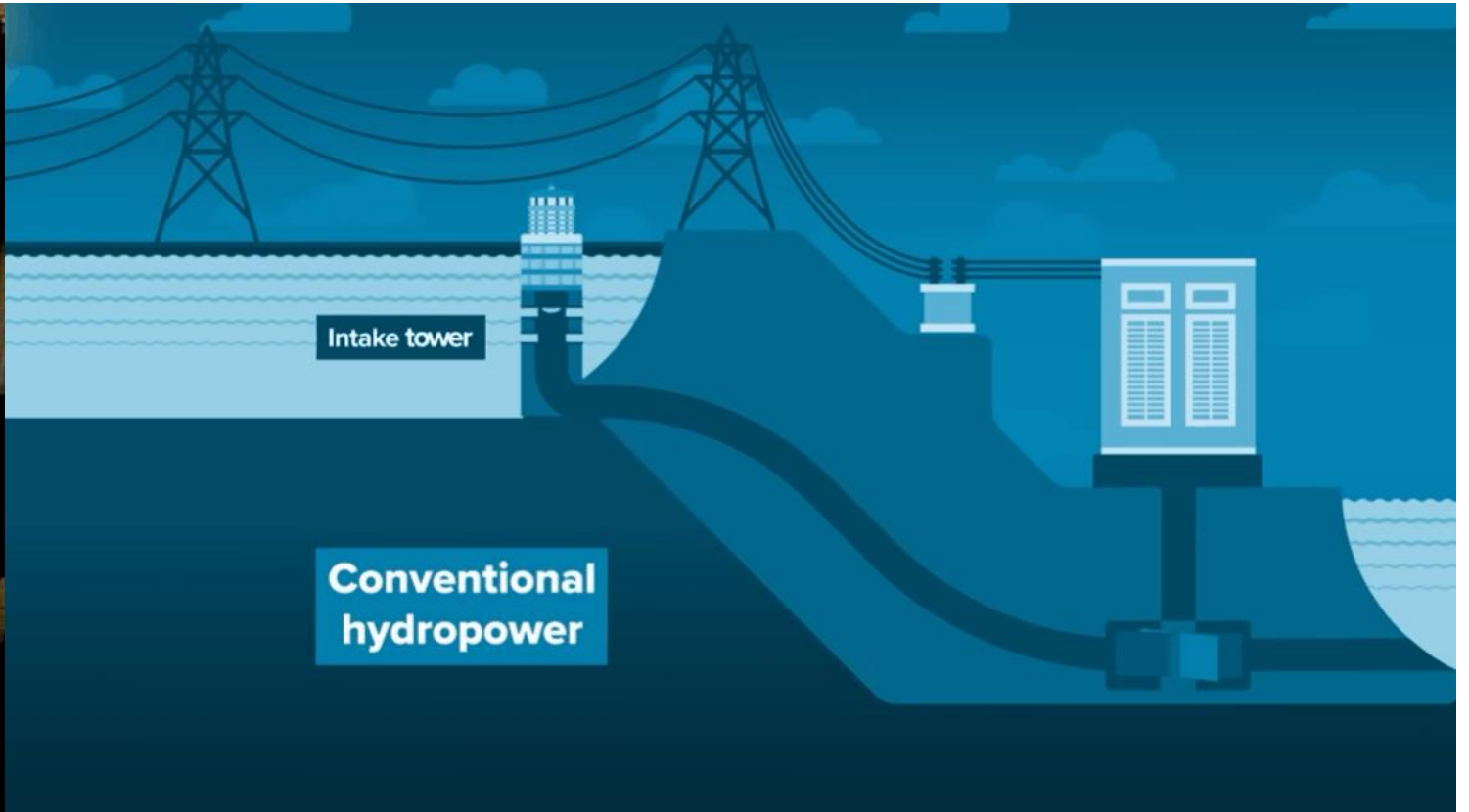
Inovasi Pemanfaatan Uap Panas Bumi untuk Pengeringan Kopi



Penyuntikan air ke batu panas yang kering.



HYDROPOWER



MICRO DAN PICO HYDRO



Optimasi geometri bak pusaran.

Berapa diameter lubang keluar yang paling ideal? Bagaimana pengaruh kemiringan dinding bak terhadap kecepatan pusaran?

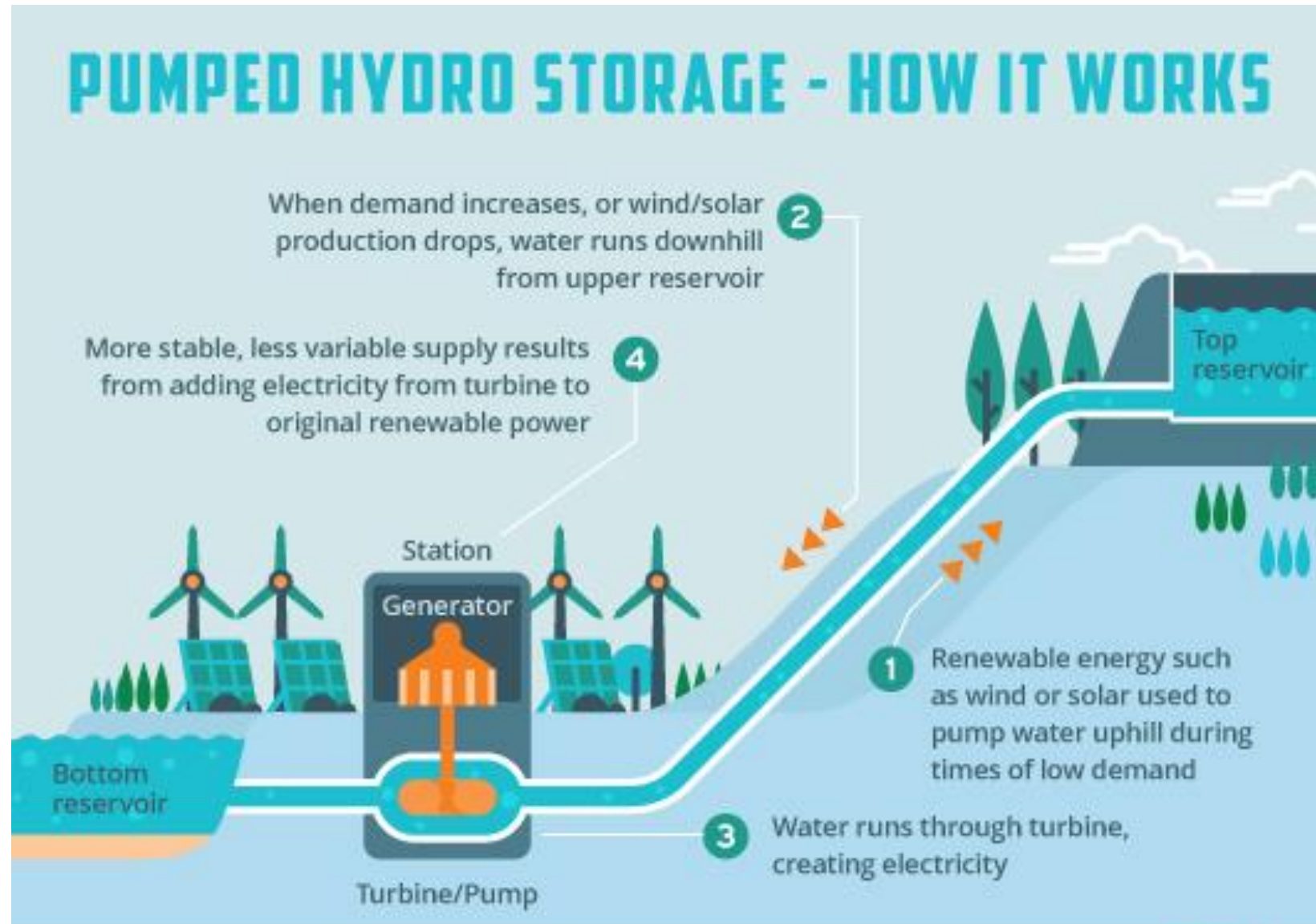
Bilah turbin.

Membuat bilah turbin menggunakan material komposit local. (misalnya serat alam seperti bambu atau rami yang dicampur resin) atau menggunakan metode *3D Printing* dengan bahan polimer daur ulang yang diperkuat.

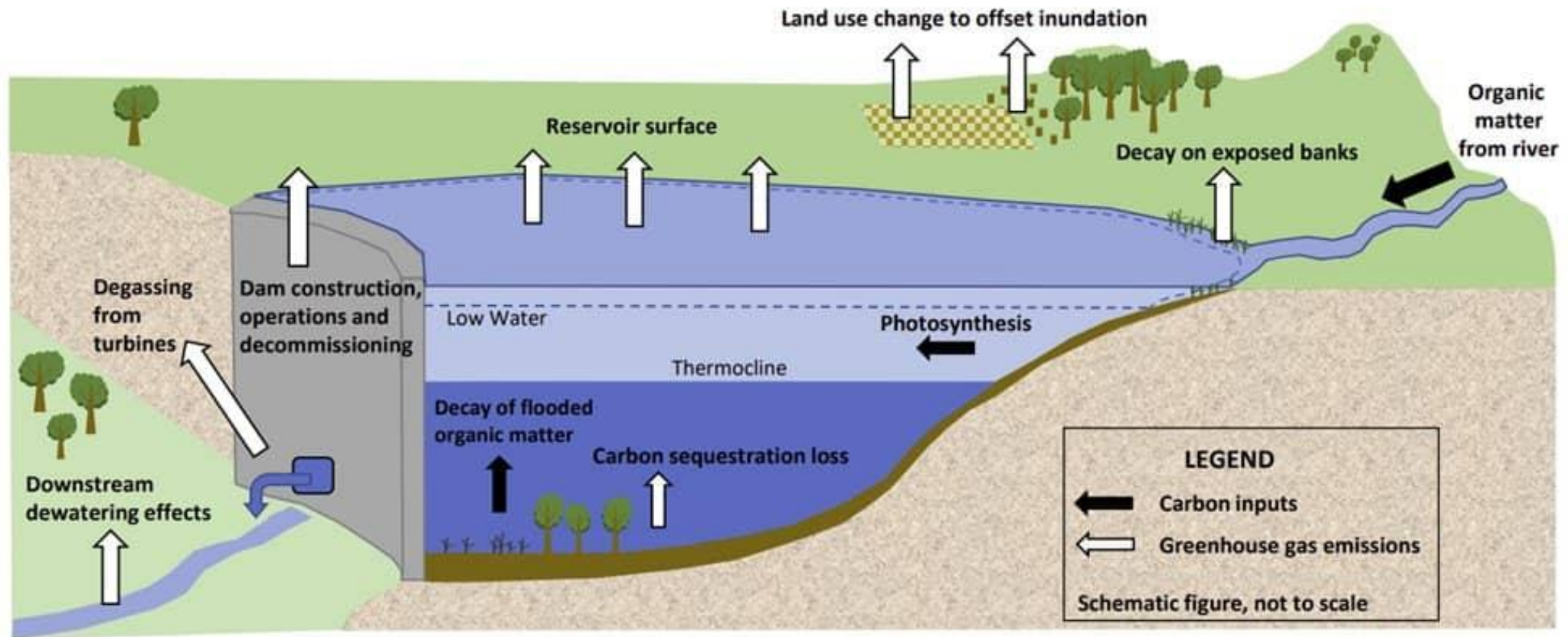
Agri Tech.

Menghilangkan generator listriknya, dan menyambungkan poros turbin air langsung ke mesin mekanik pertanian. Misalnya, putaran turbin langsung memutar mesin perontok padi, mesin penggiling kopi, atau pompa air irigasi sawah dataran tinggi.

Sistem Penyimpanan Energi Pompa (*Pumped Hydro Energy Storage* / PHES)



Eko-Hidrologi dan Emisi Gas Rumah Kaca Waduk

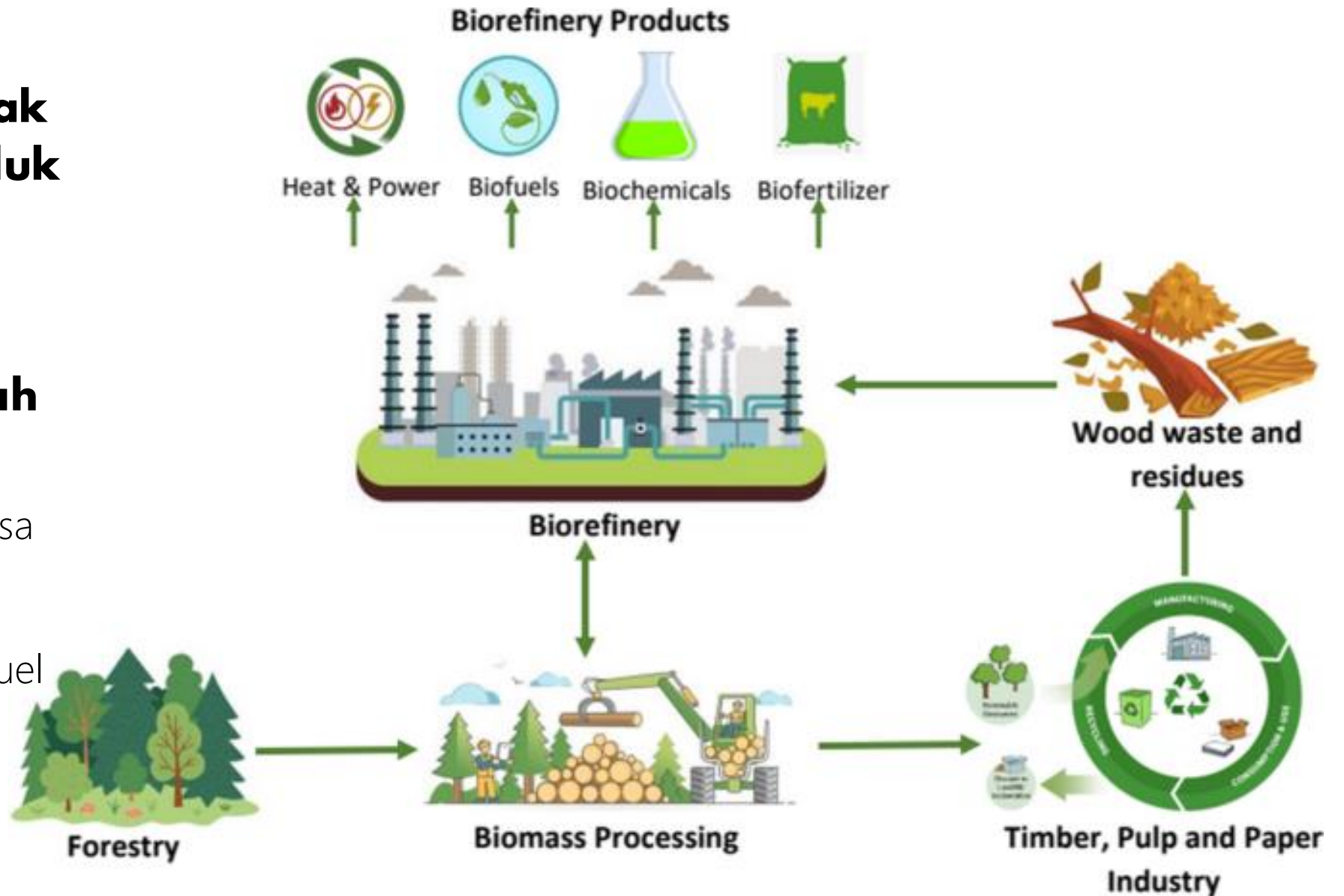


BioMassa

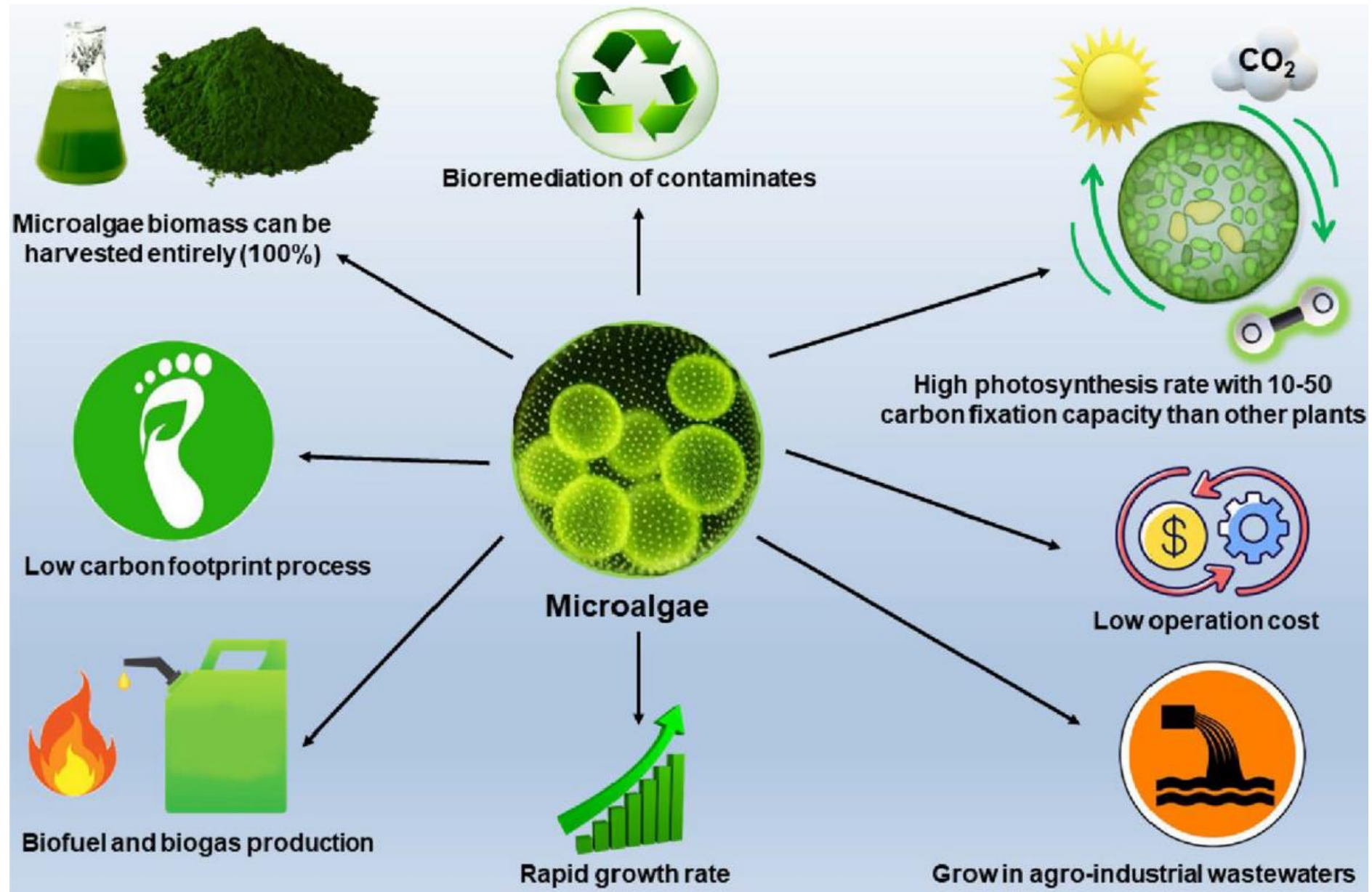
Tren biomassa tidak menjadi satu produk saja (misal hanya jadi biodiesel).

Tren saat ini adalah Biorefineri.

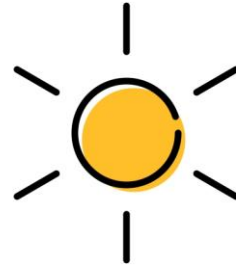
Satu jenis limbah biomassa diolah menggunakan pendekatan bertingkat untuk menghasilkan biofuel (energi), bioplastik (material), dan biokimia berharga tinggi secara bersamaan



Microalgae sebagai pemeran utama Biomassa



Solar Energy



Si paling populer



Concentrated Solar Power (CSP)



Photovoltaic (PV)

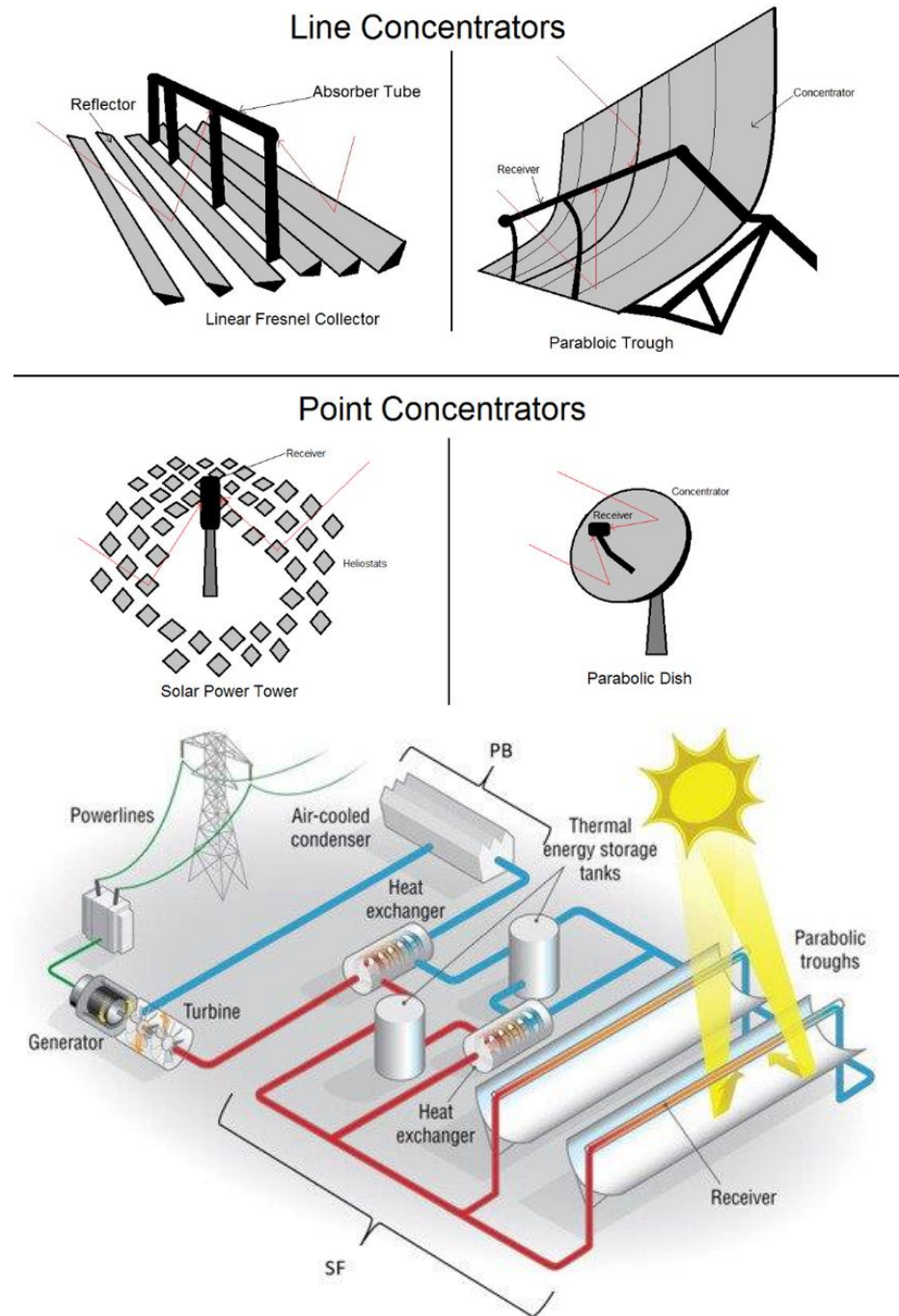
- **Terjangkau (Price Performance ratio)**
- **Sangat Fleksibel (Scalability & Modularity)**
- **Kecepatan Pembangunan (Speed of Installation)**
- **Minim Risiko Geografis**

Solar Power

Concentrated Solar Power (CSP)



World's largest CSP in Dubai



Solar Power Photovoltaic (PV)

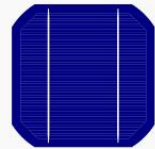


Japan's floating power plant



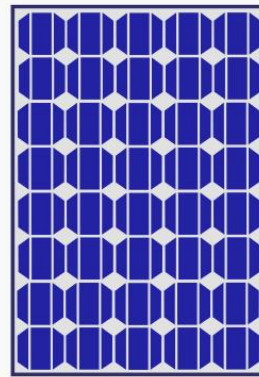
Sideways solar panel

From a solar cell
to a PV System

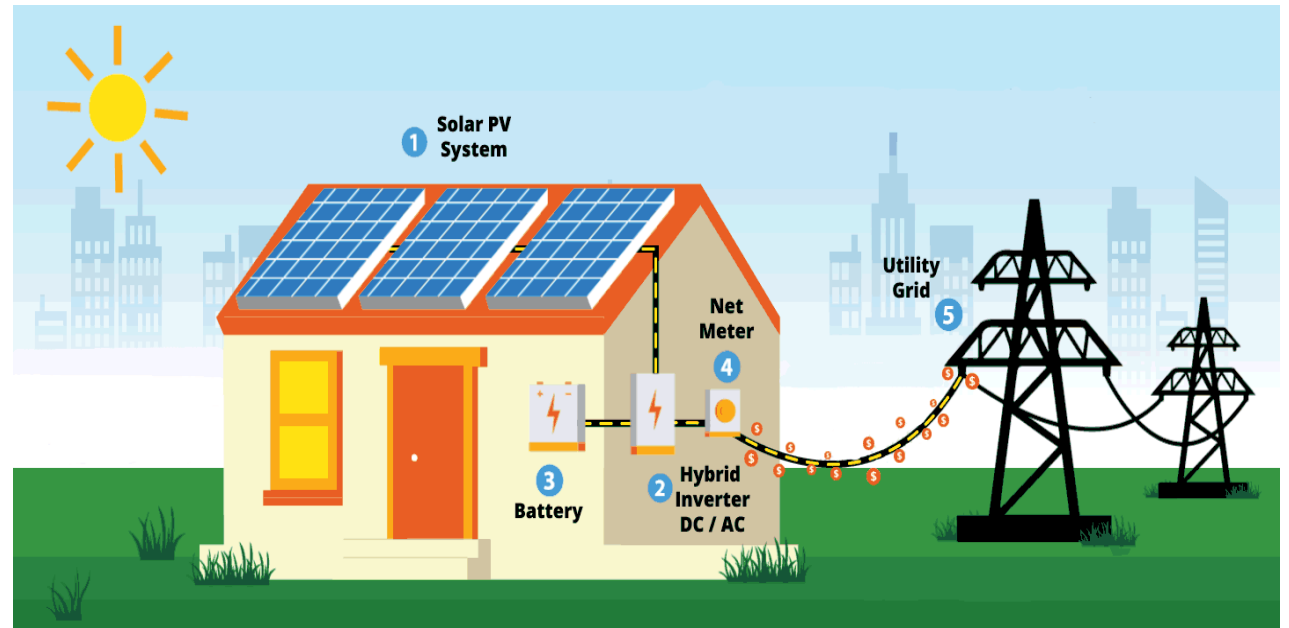
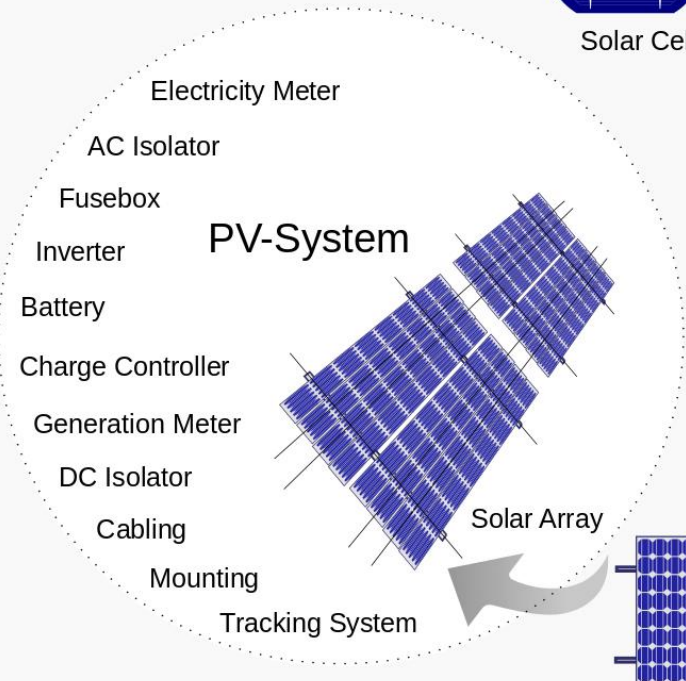
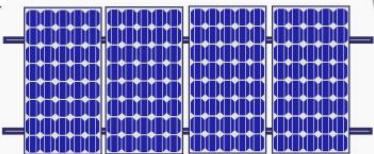


Solar Cell

Solar Module



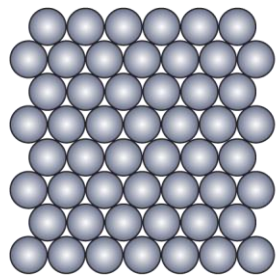
Solar Panel



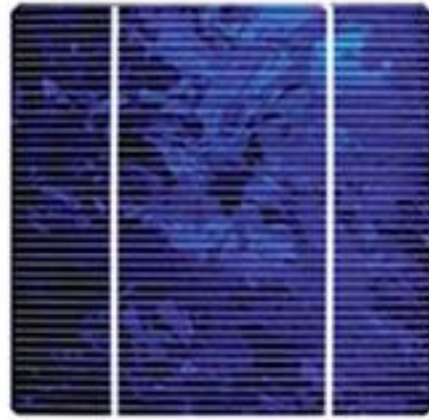
Type Silicon Solar Cell



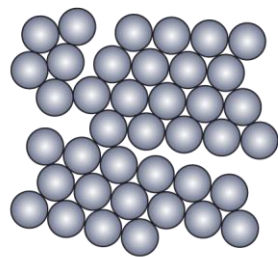
Mono



(a) Monocrystalline

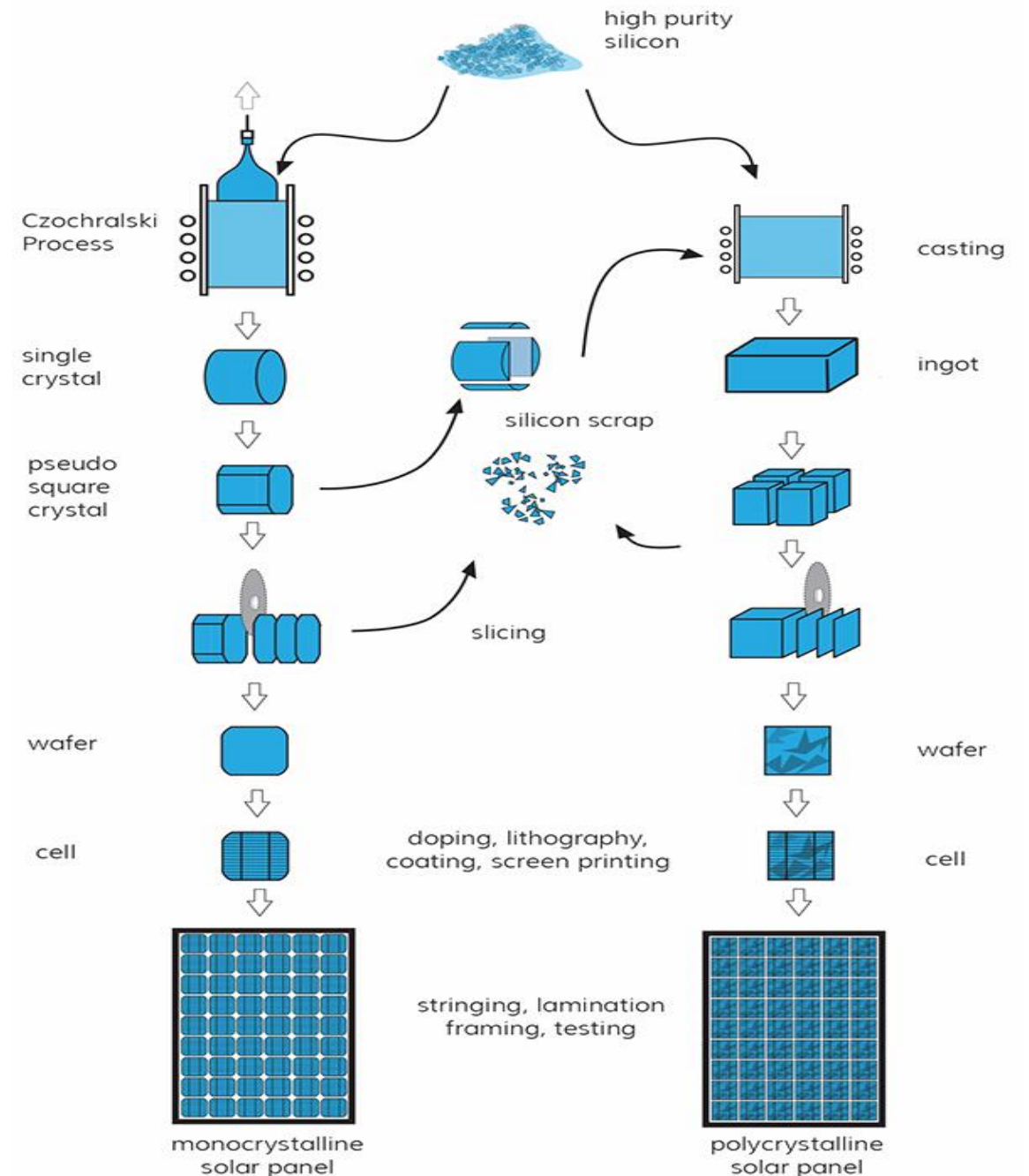


Poly

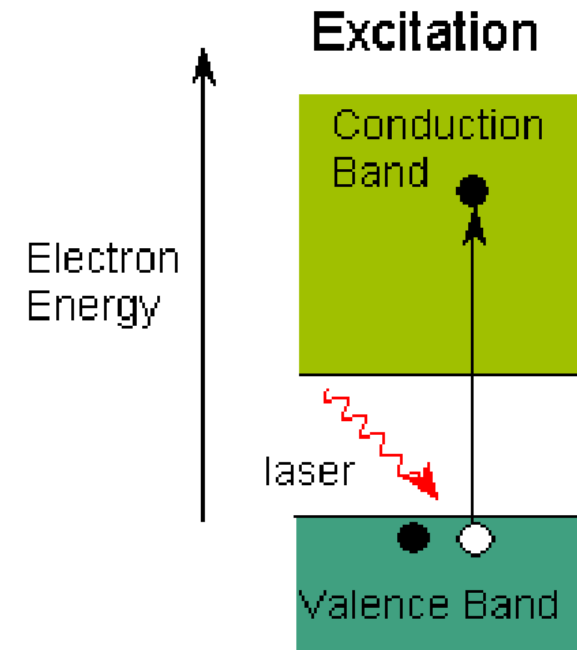
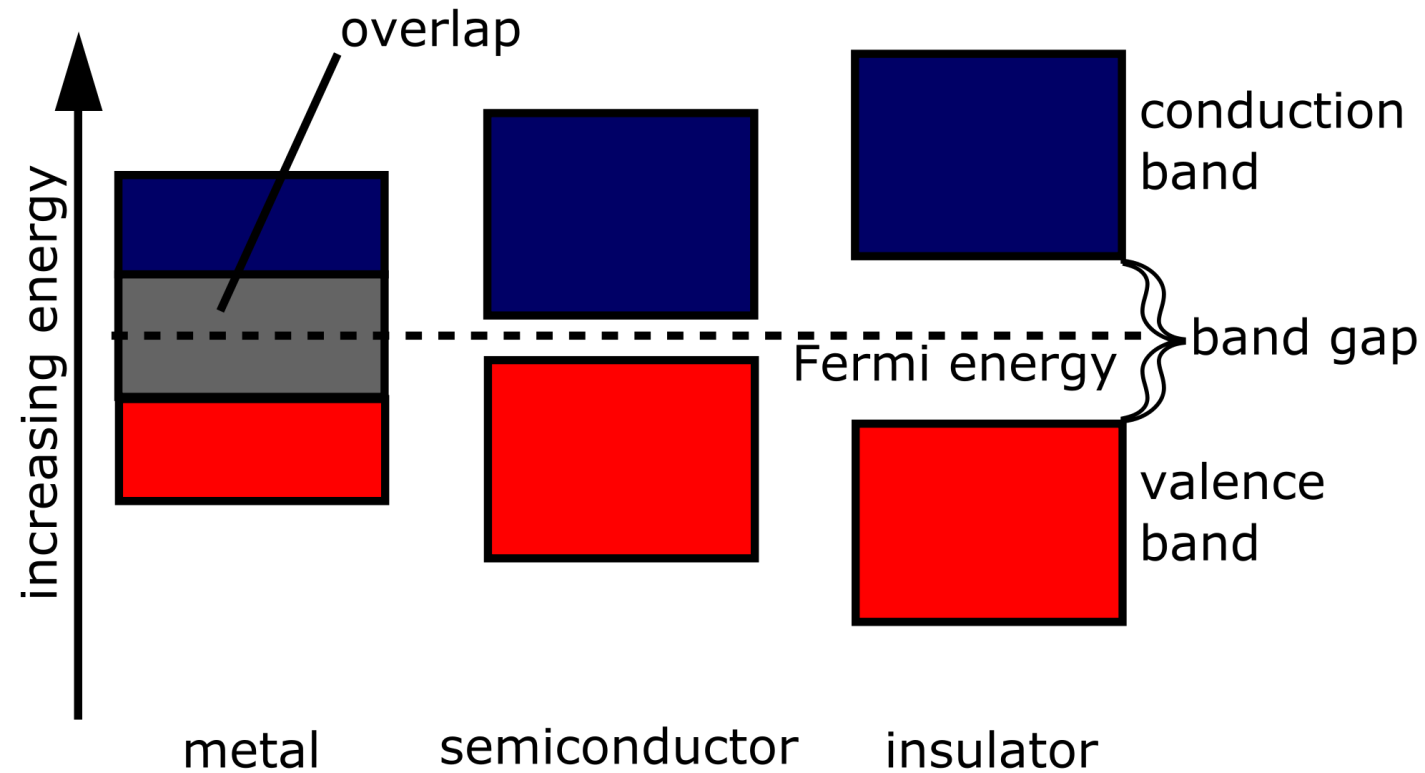
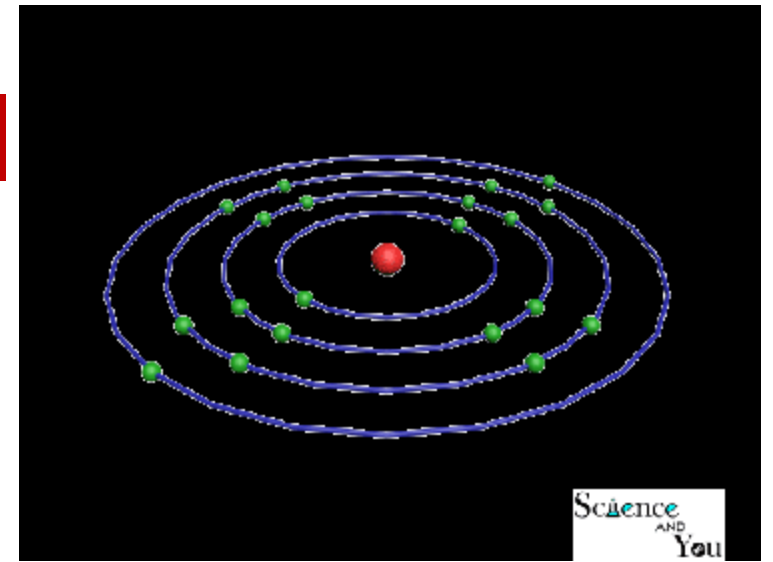


(b) Multicrystalline

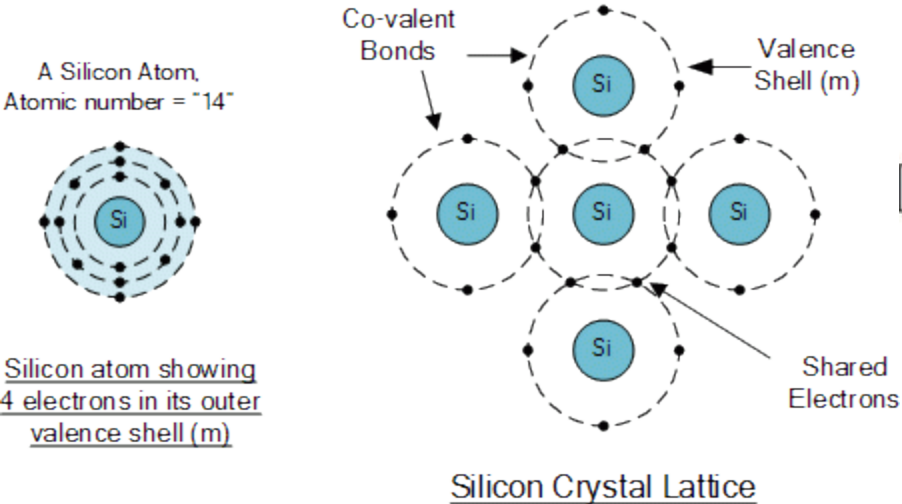
Figure 1: Schematic structures of silicon



Electric Properties Material

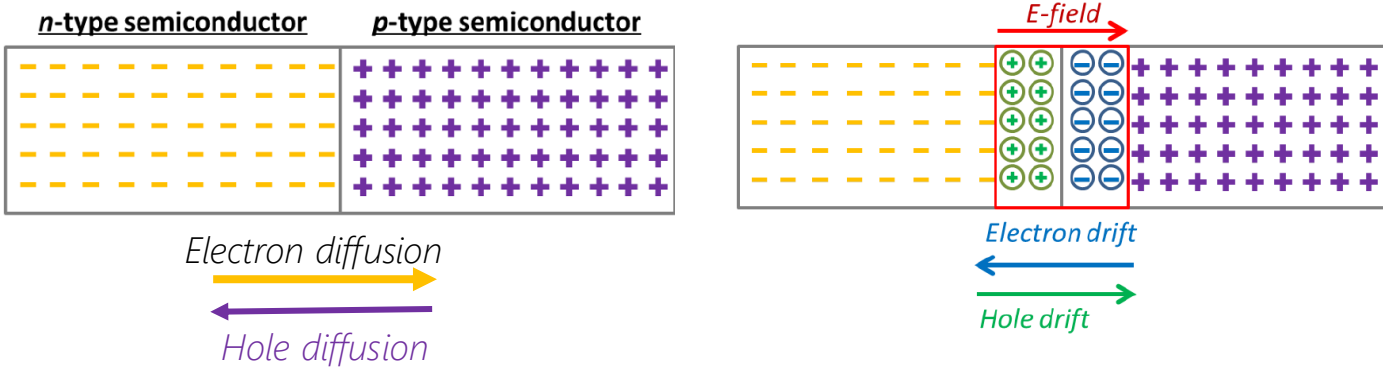
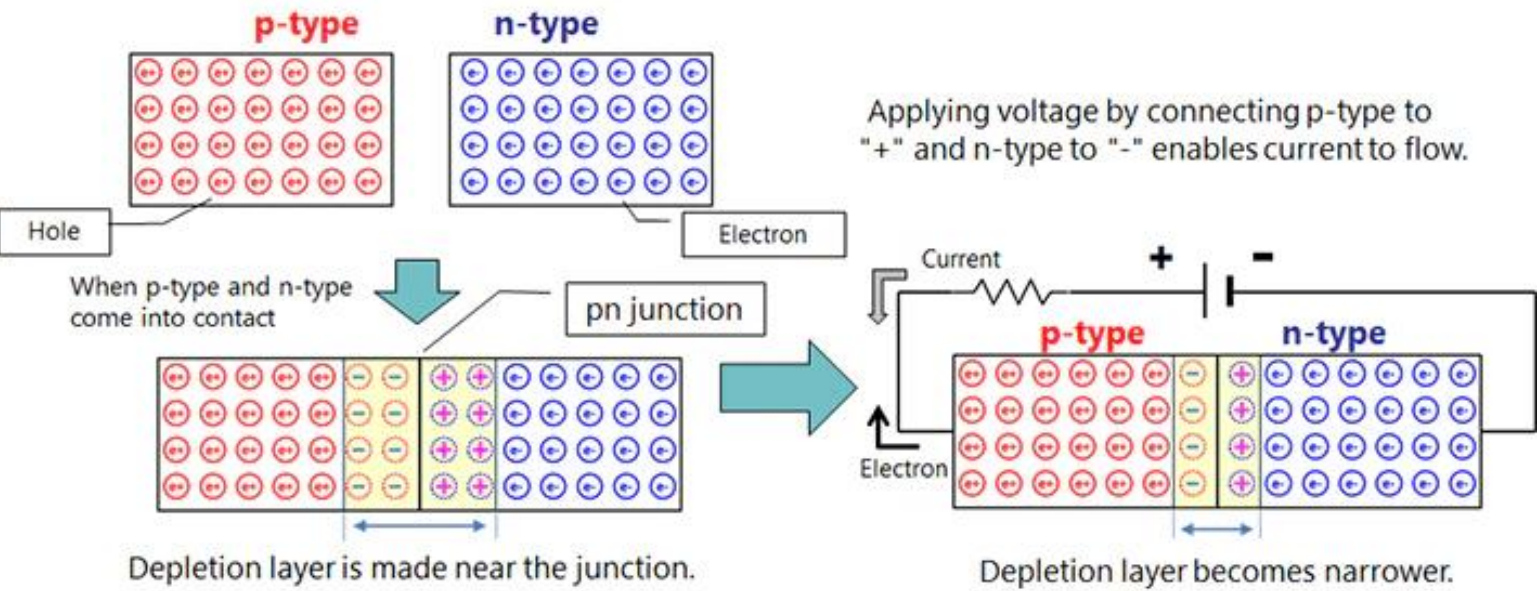
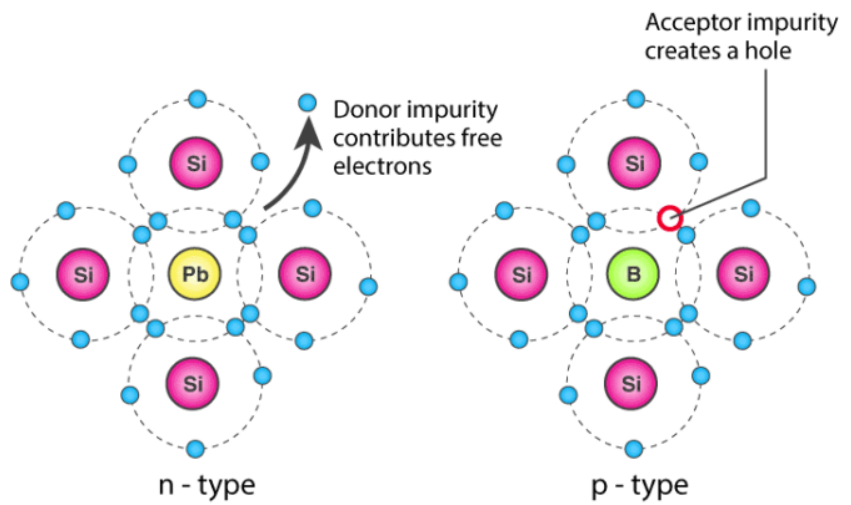


Silicon Semiconductor

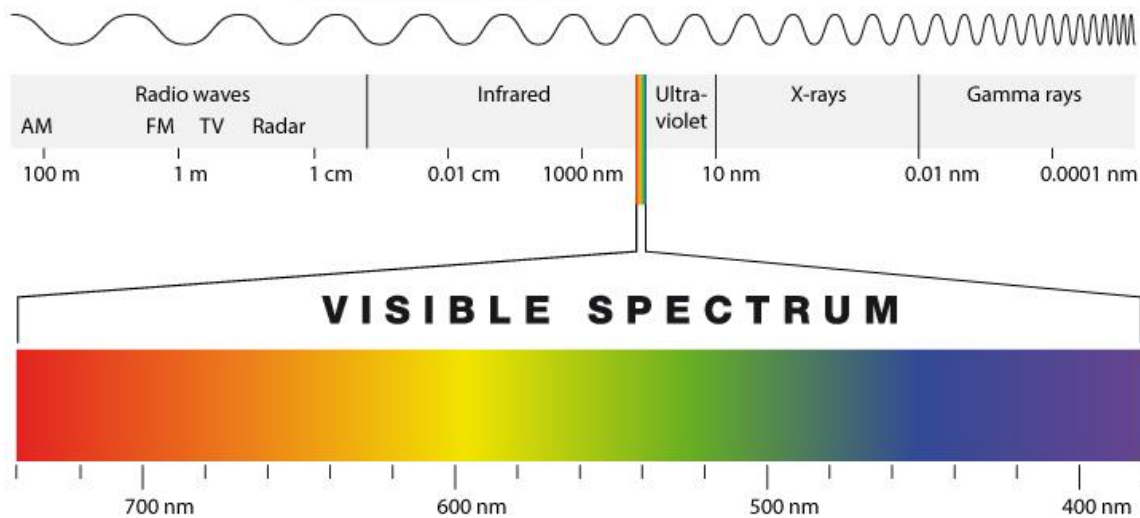


Silicon atom showing 4 electrons in its outer valence shell (m)

EXTRINSIC SEMICONDUCTORS

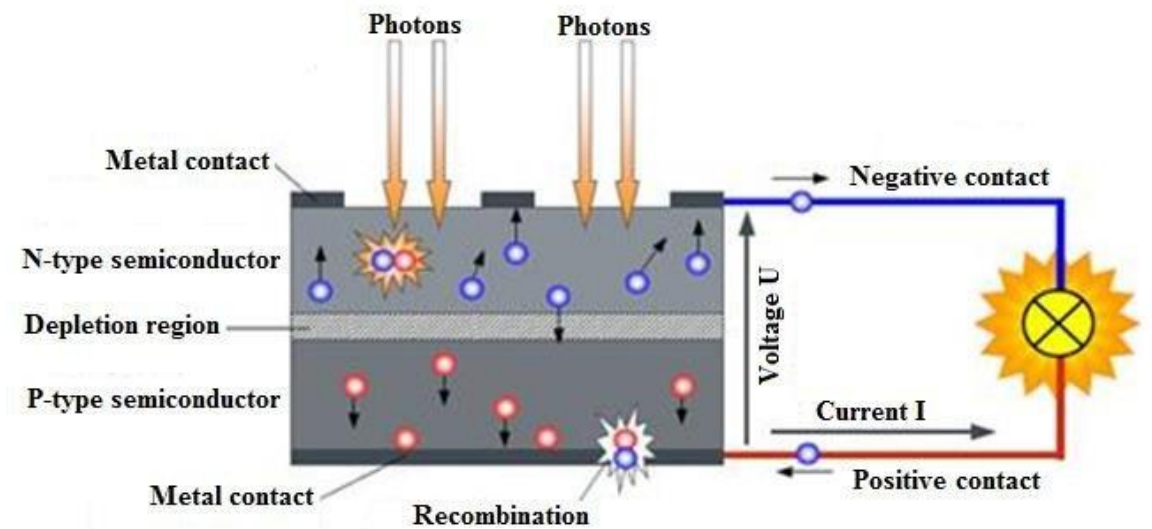
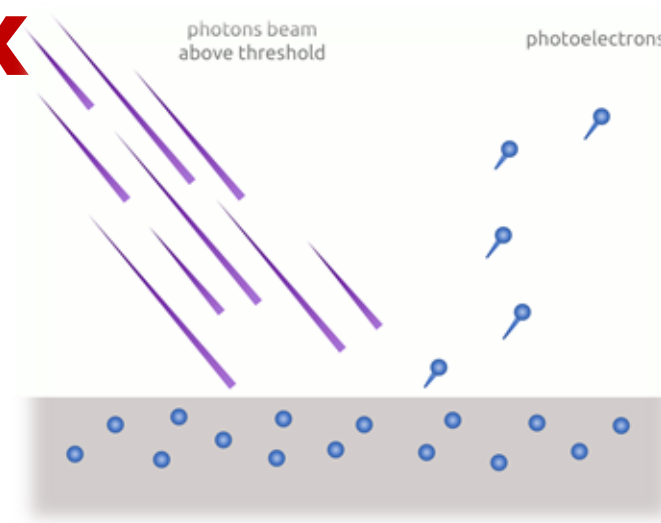


How Silicon Solar Cell Work



$$E = \frac{hc}{\lambda}$$

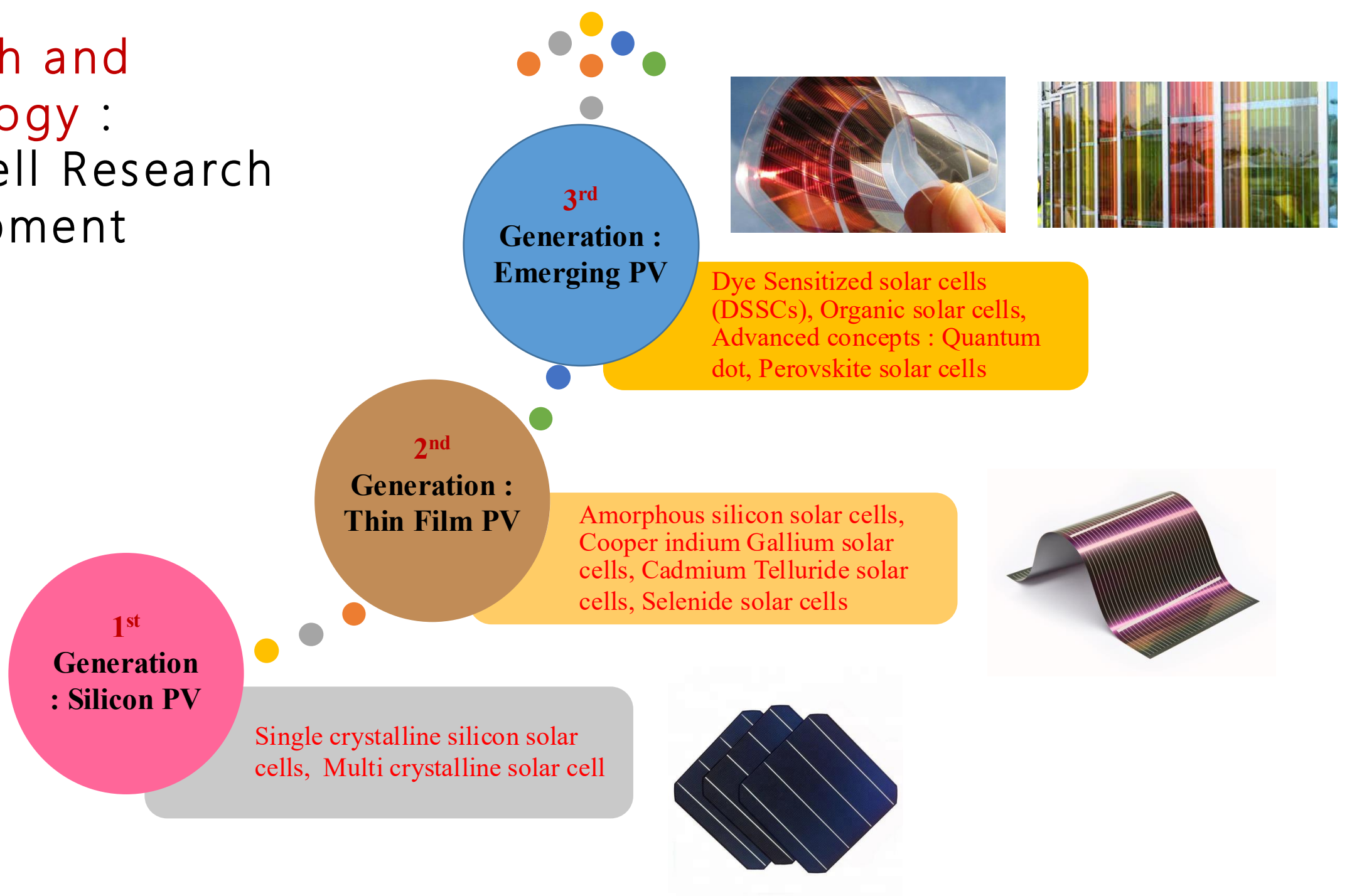
h = Planck's constant ($6.63 \times 10^{-34} \text{ m}^2\text{kgs}^{-1}$)
 c = Speed of light in vacuum ($3 \times 10^8 \text{ ms}^{-1}$)
 λ = photon's wavelength (m)



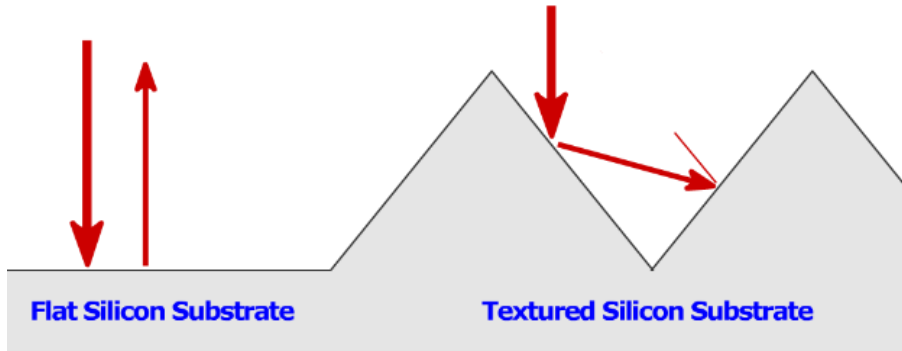
Solar Cell Principle

- Hole = positive charge
- Electron = negative charge

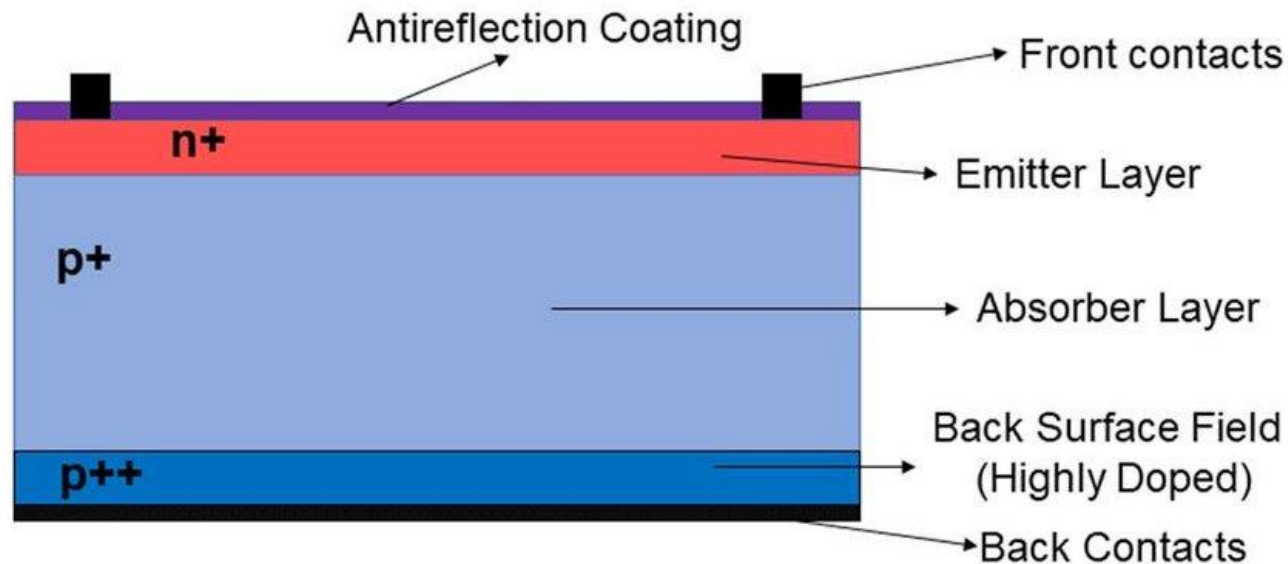
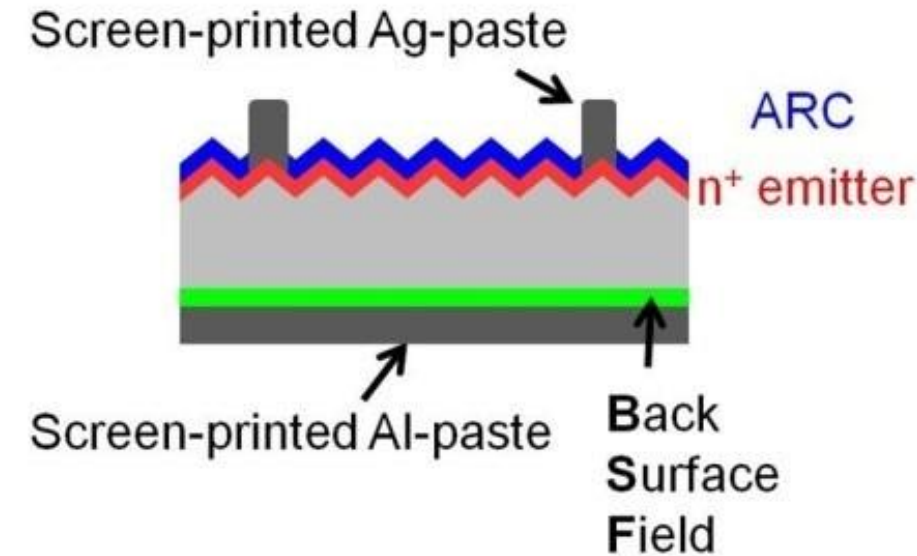
Research and Technology : Solar Cell Research Development



Standard Silicon Solar Cell

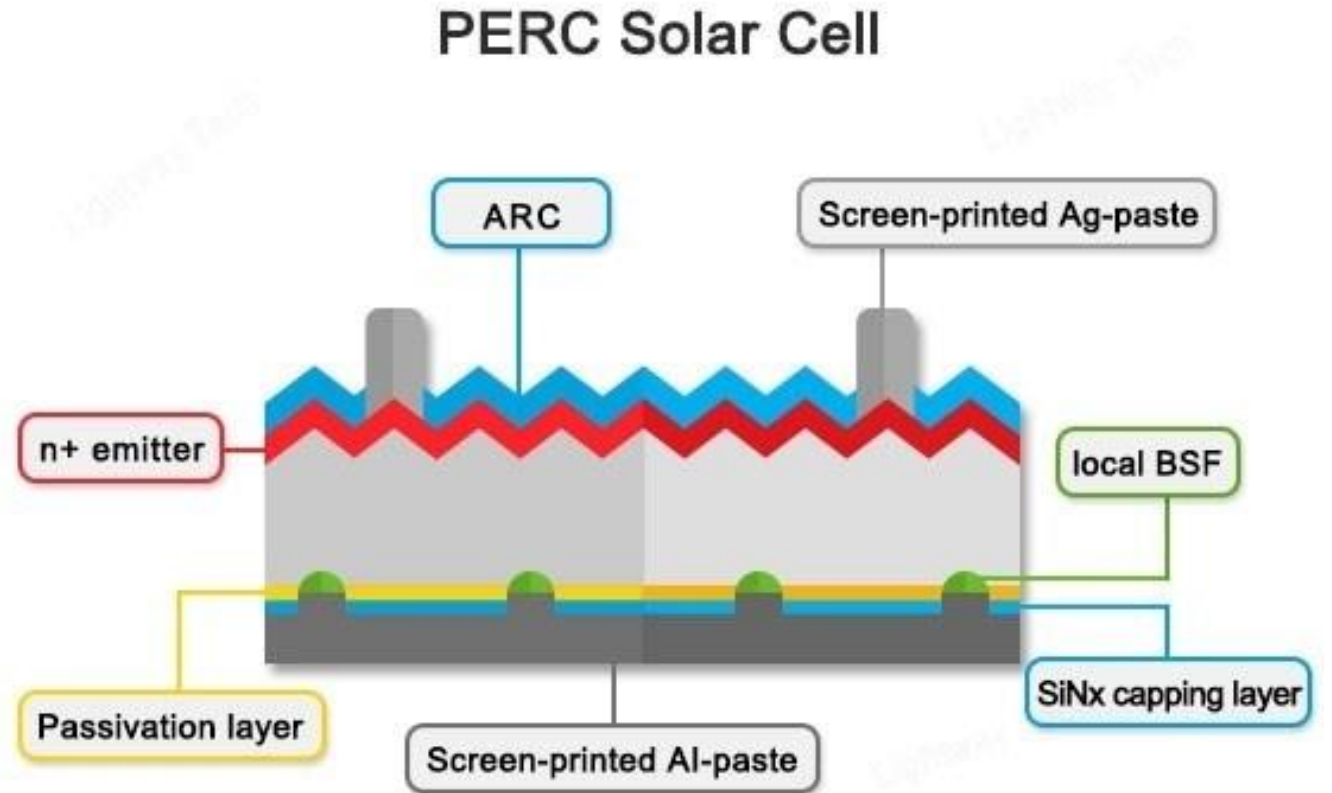
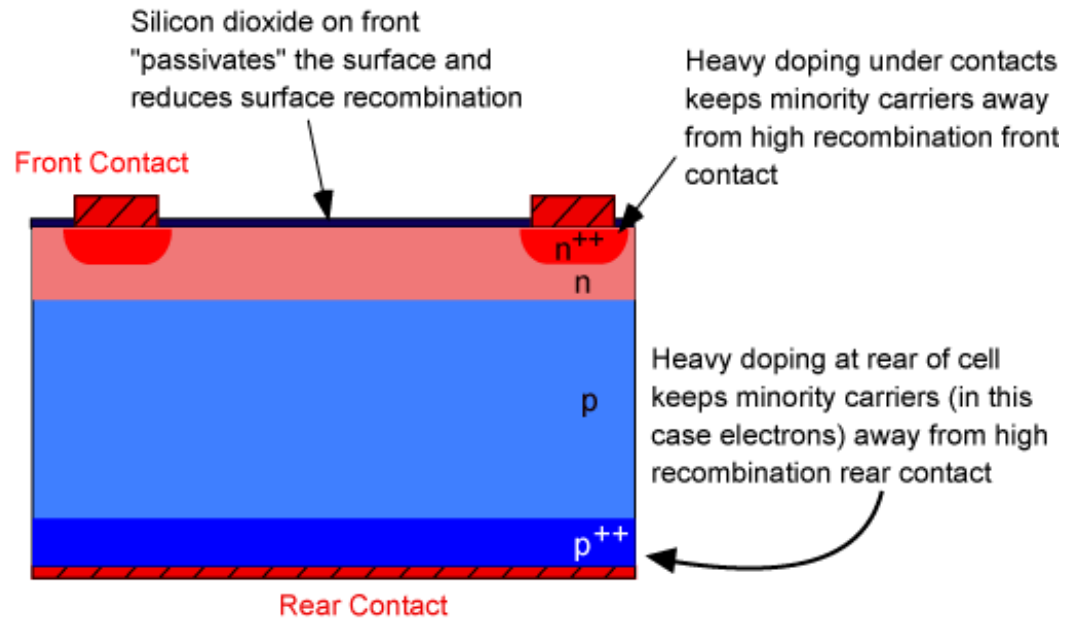


Standard solar cell

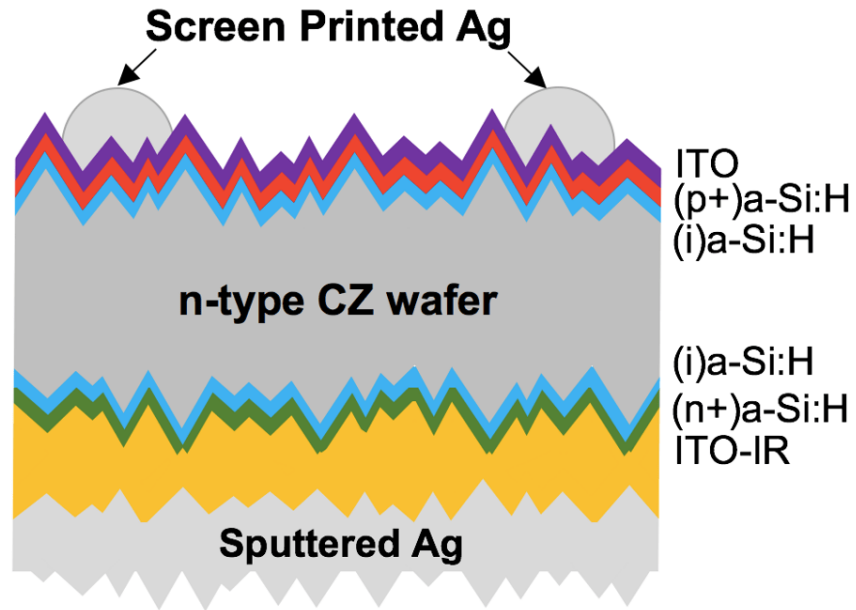


PERC Solar Cell

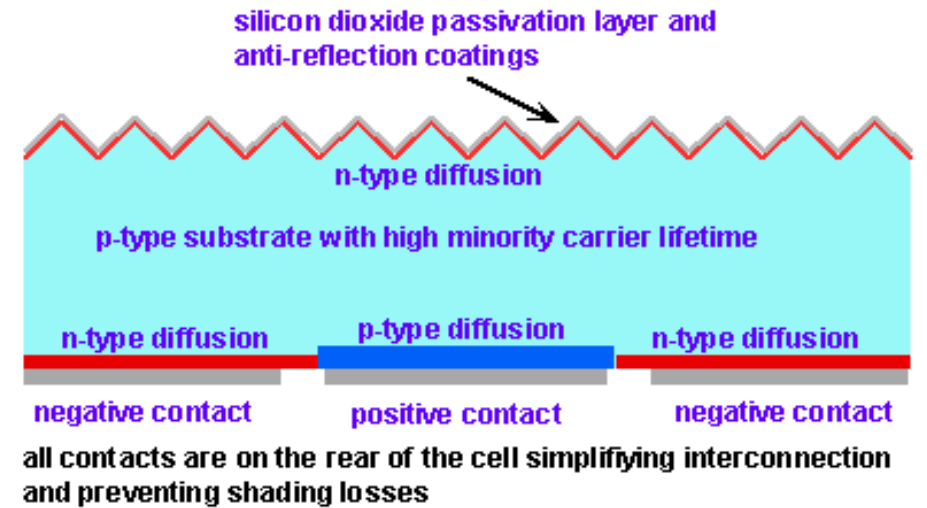
(Passivated Emitter and Rear Contact)



Heterojunction & Back Contact

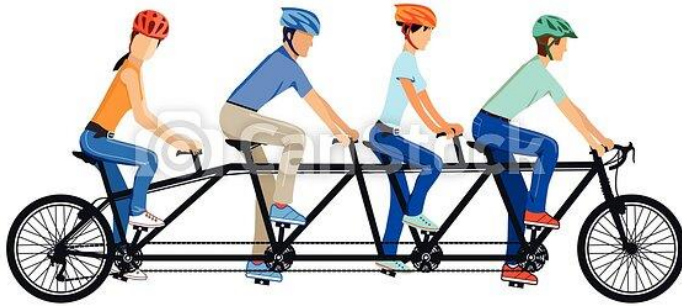


Si-Heterojunction

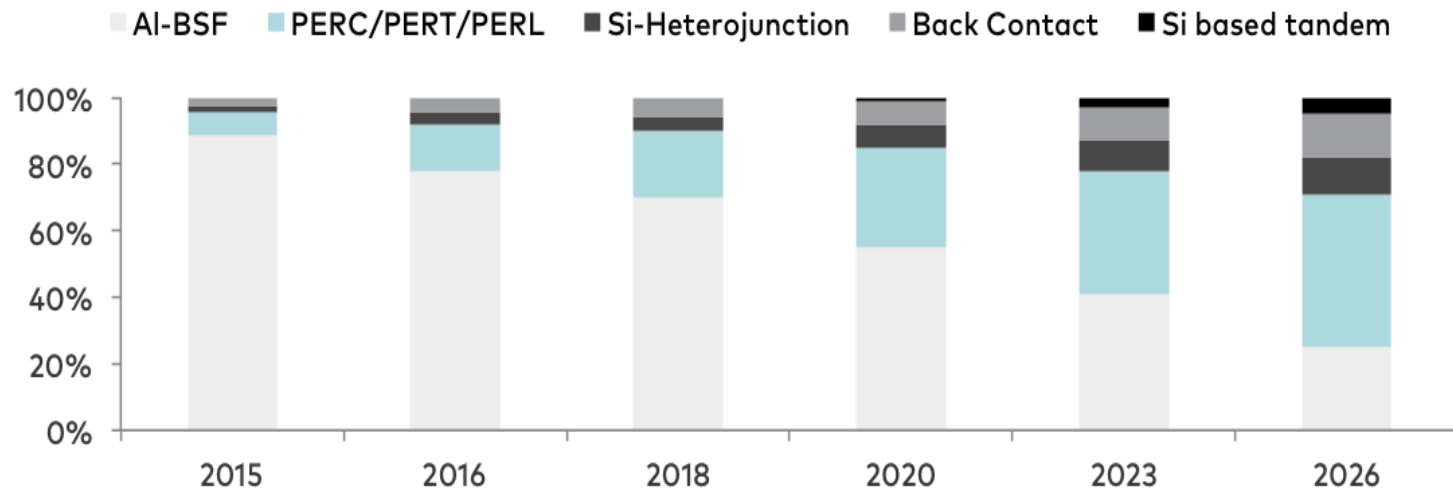
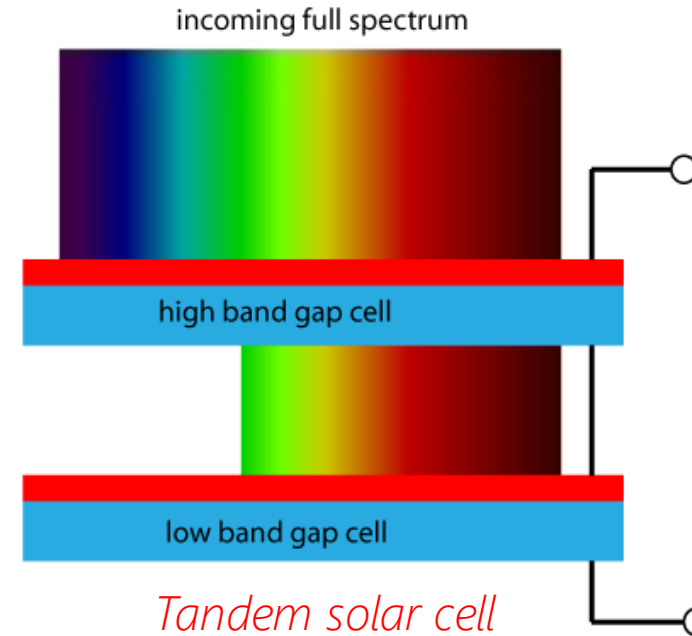


Back Contact

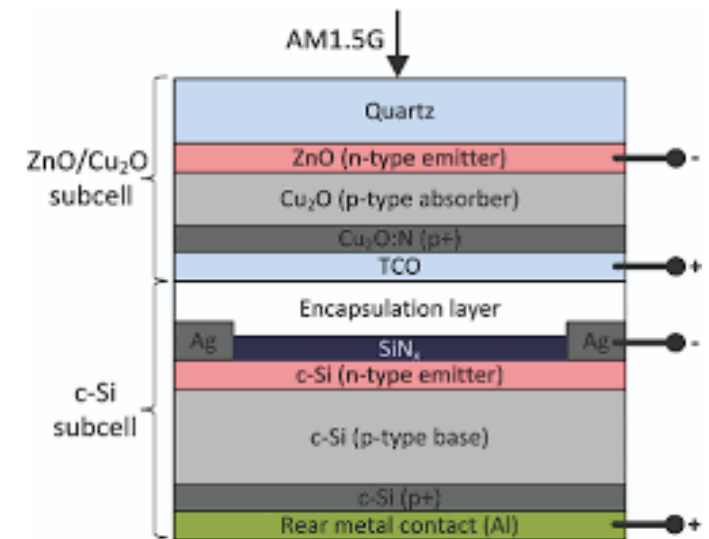
Tandem Solar Cell



Tandem bike



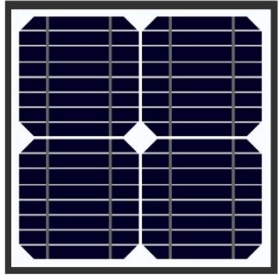
Source: ITRPV



Si-Based Tandem

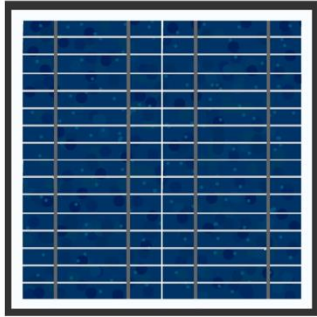
Thin Film Solar Cell

Size Comparison of Photovoltaic Panel of Similar Power Output



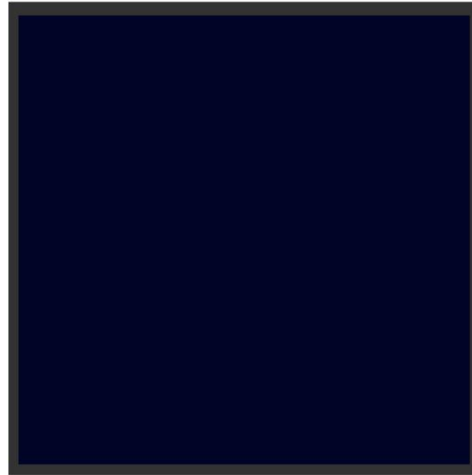
Mono Crystalline Solar Panel

15-22% Efficiency

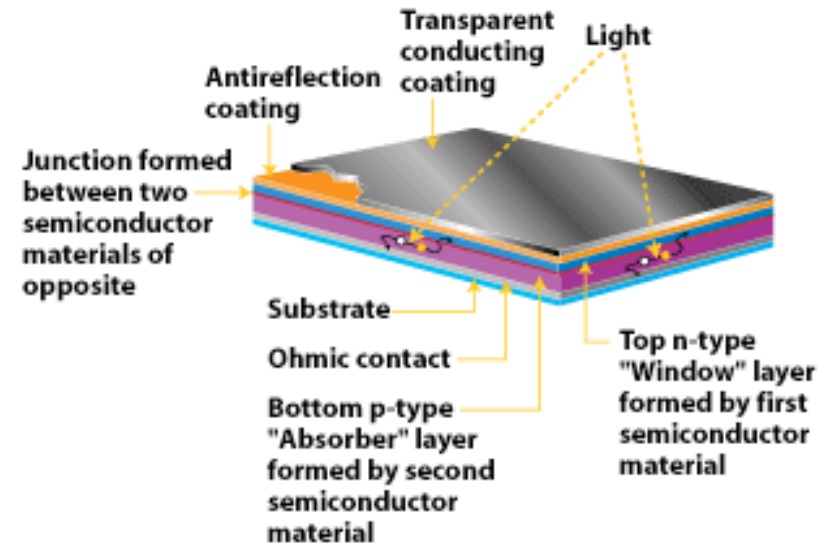


Poly Crystalline Solar Panel

13-18% Efficiency



Thin Film Solar Panel
9-11% Efficiency



Structure of thin film solar cells

Substrate :

- Cadmium Tellurium (CdTe)
- Amorphous Silicon (a-Si)
- Copper Indium Gallium Selenide (CIGS)
- Gallium Arsenide (GaAs)



Tesla solar car



Solar bag

Advantages:

- Lightweight
- Cost less
- Use less silicon (environmental friendly)

Disadvantages:

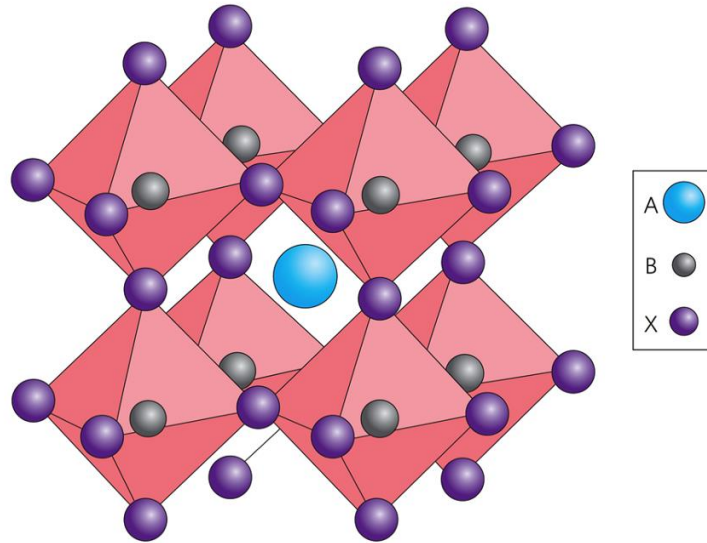
- Cadmium toxic
- Less efficiency

Perovskite Solar Cell

Structure in Perovskite Solar cell



Example:
 CaTiO_3



Perovskite crystallographic
structure

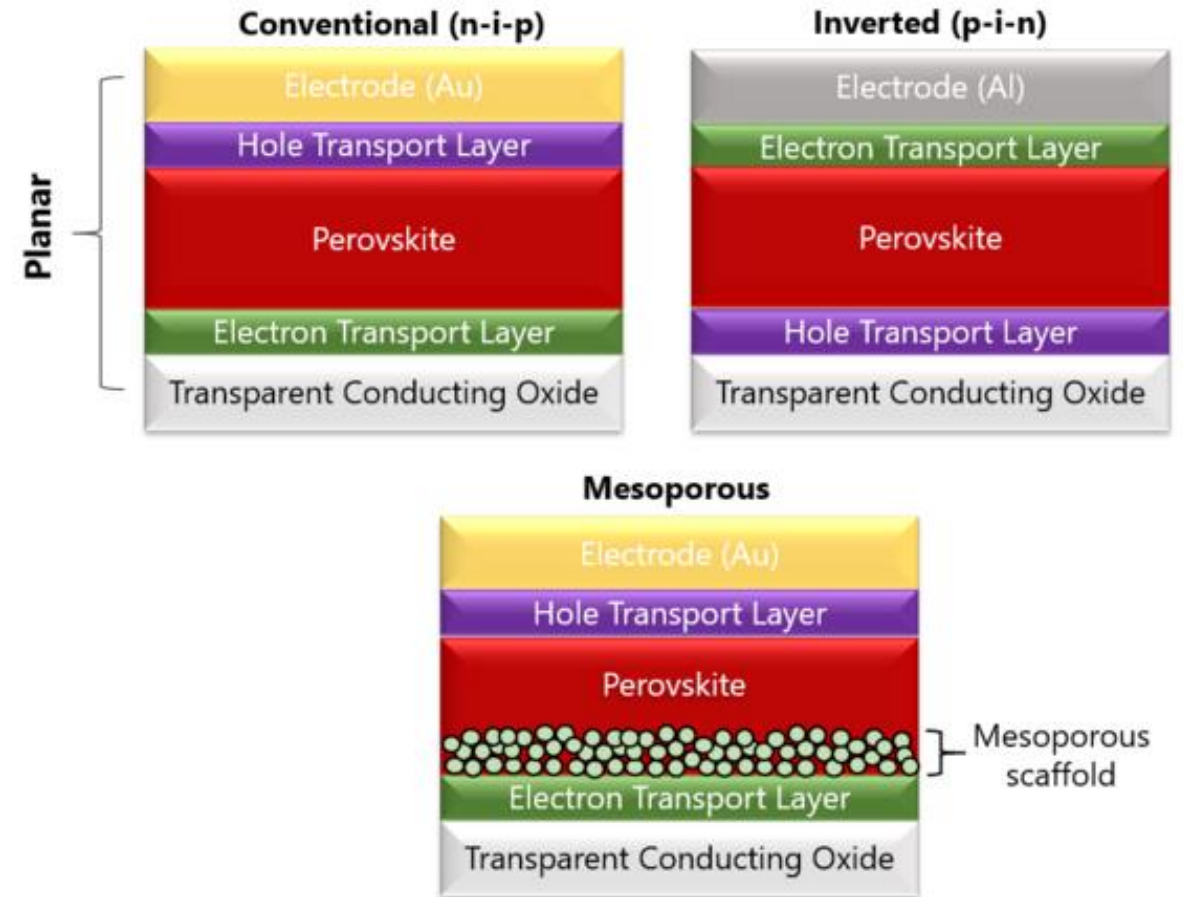


Properties :

- Semiconductor
- High absorption coefficient
- High dielectric constant



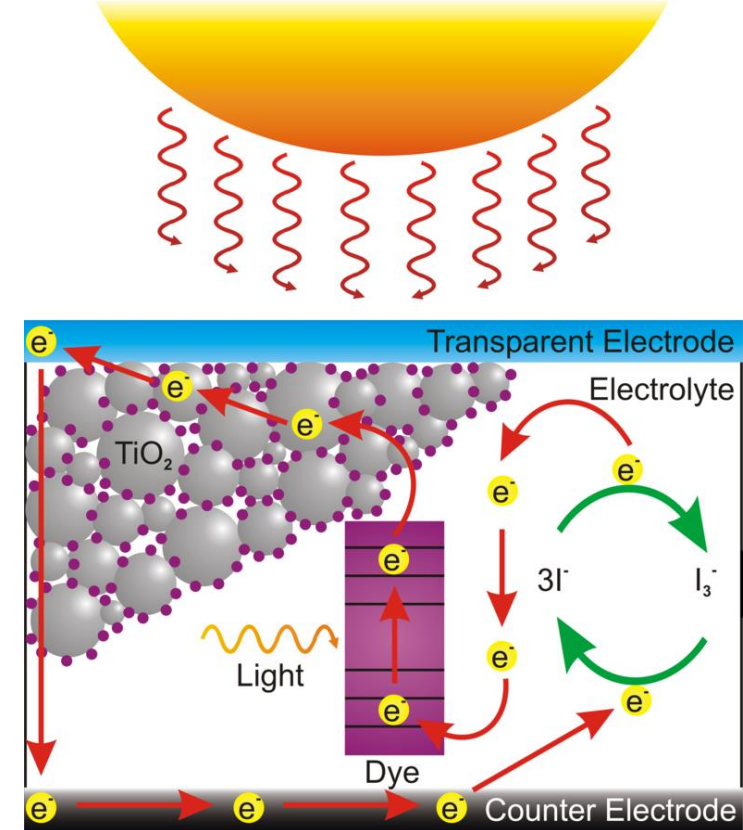
Photovoltaic



Dye Sensitized Solar Cell (DSSCs)



DSSCs in Swiss convention center



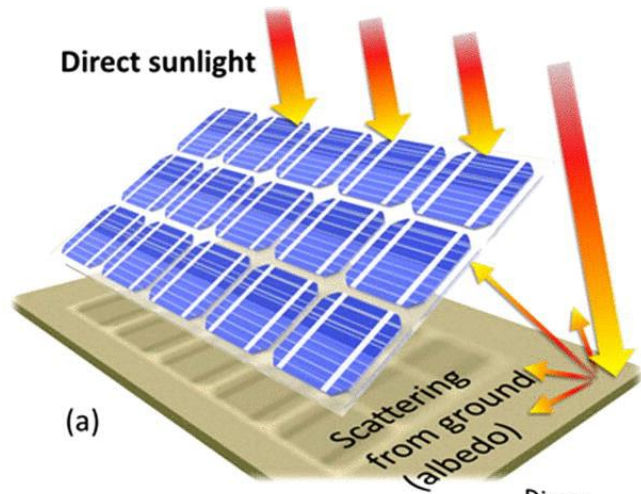
Advantages:

- Work under low light condition
- Low cost
- Environmental Friendly

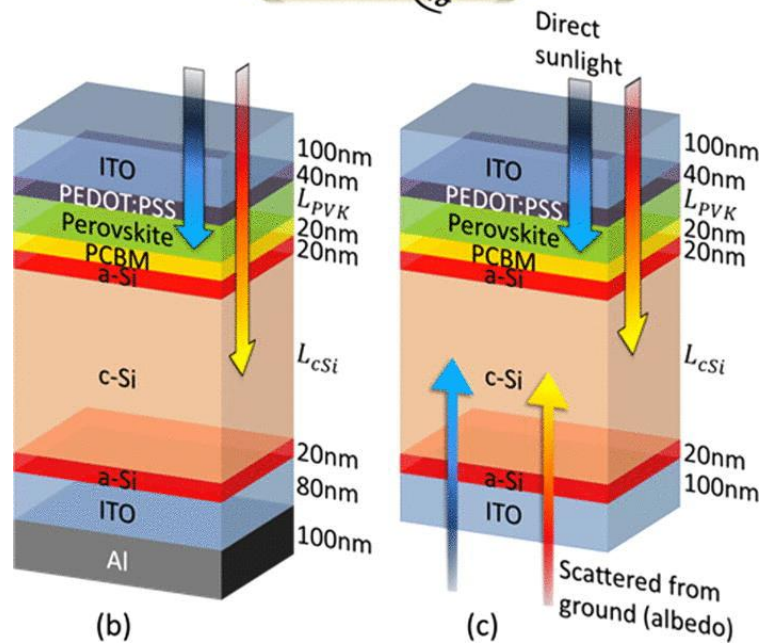
Disadvantages:

- Low efficiency (<10%)
- Short lifetime

Bifacial Solar Cell



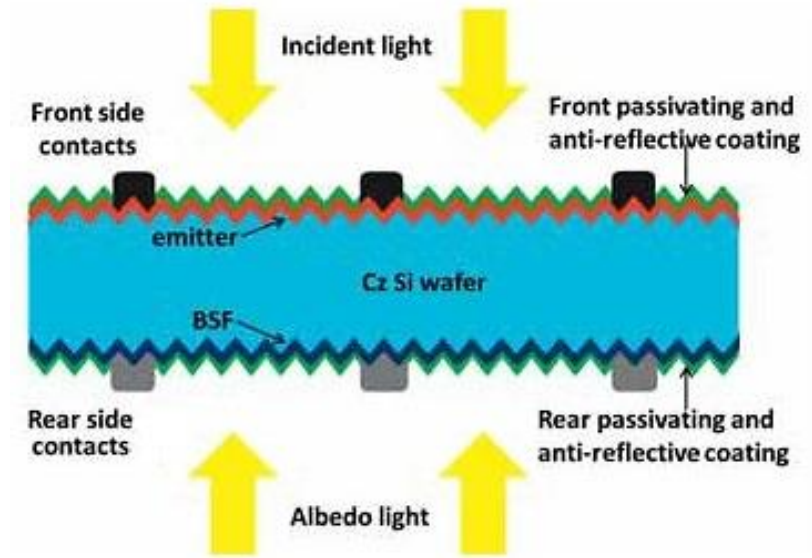
(a)



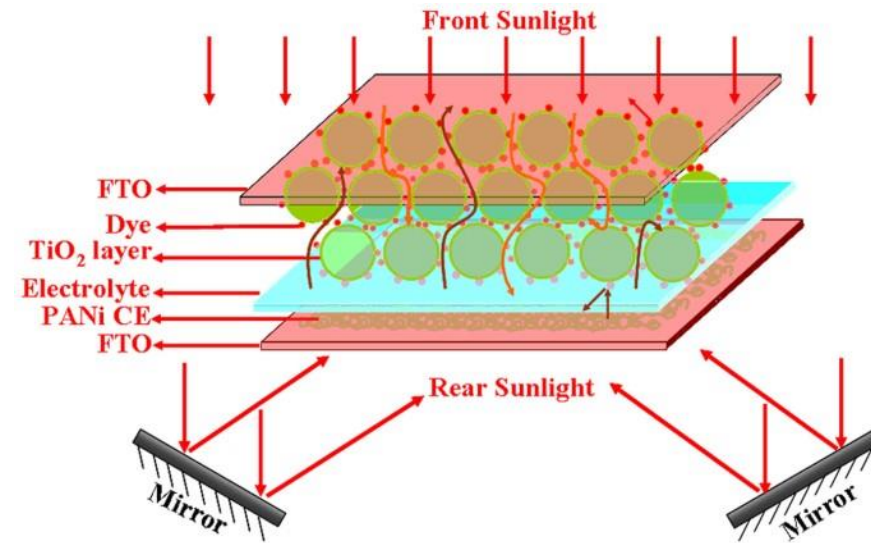
(b)

(c)

Tandem Solar Cell



Standard Si Solar Cell

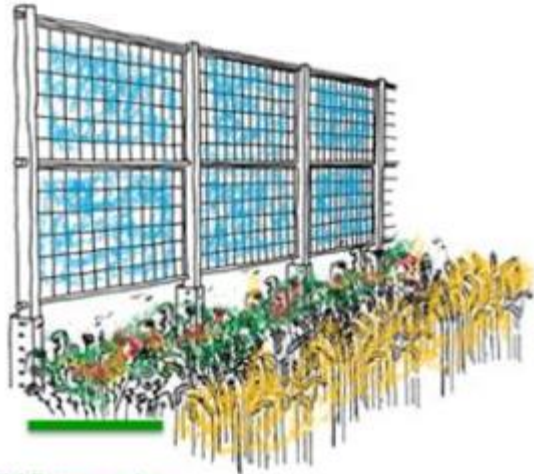


DSSCs

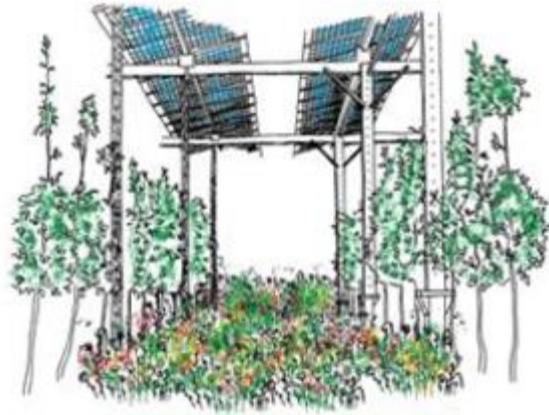
Agri-PV



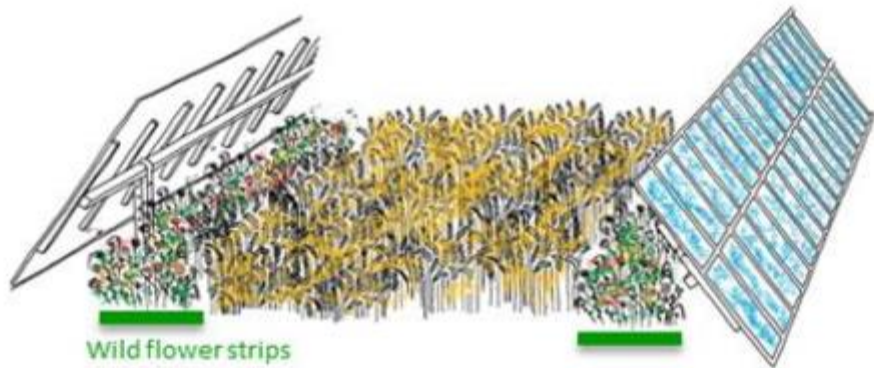
Bentuk pendekatan



Wild flower strips
along the module arrays

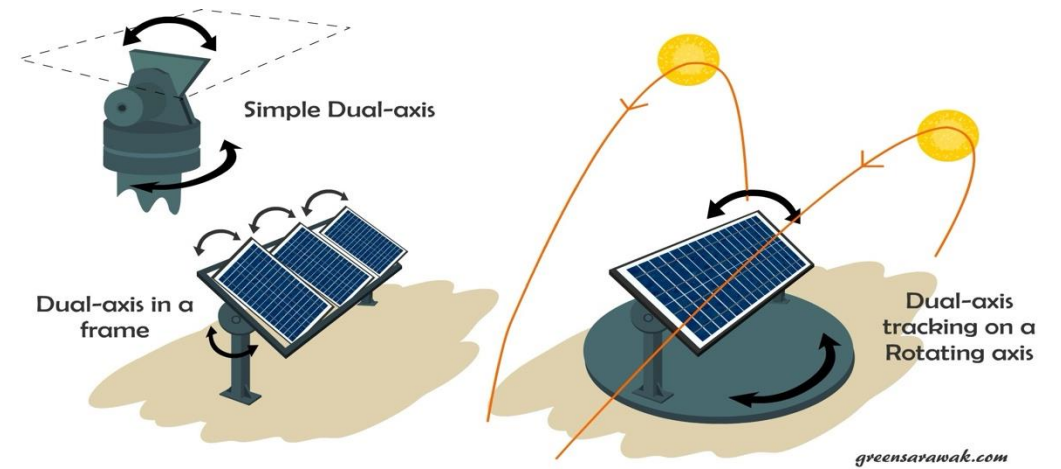
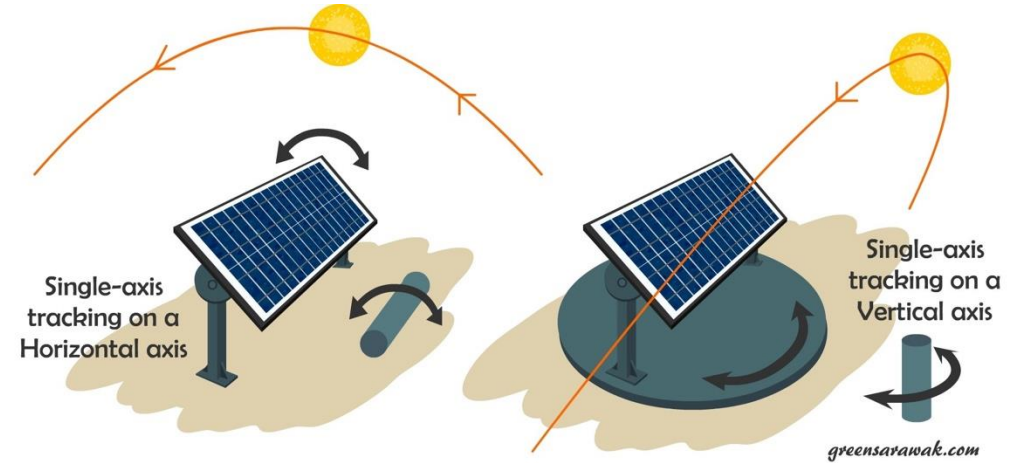


Wild flower strips



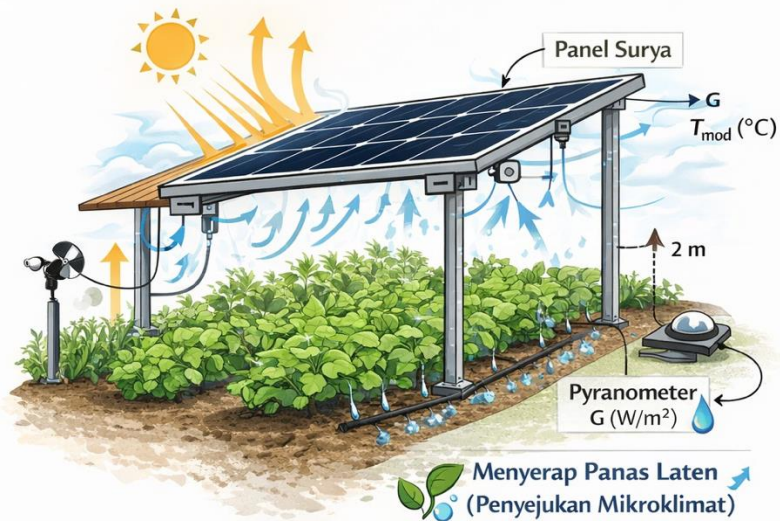
Wild flower strips

Active Solar Tracking Systems



Pengaruh Evapotranspirasi Tanaman terhadap Pendinginan Panel Surya

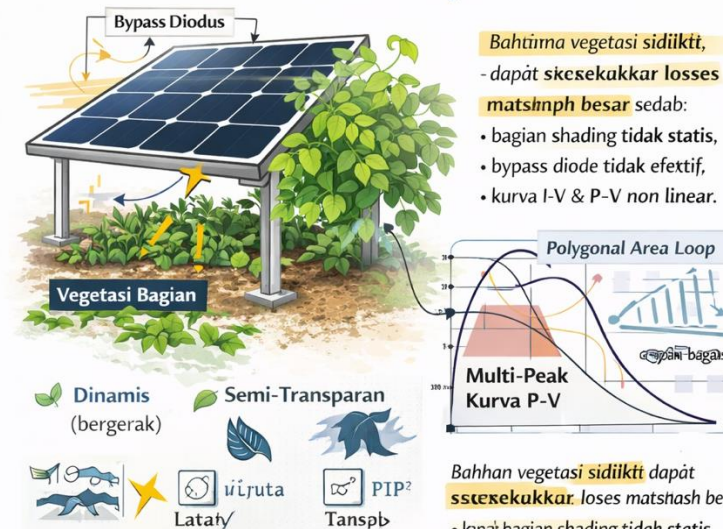
Evapotranspirasi (evaporasi tanah + transpirasi tanaman) menyerap panas **laten** dan menyejukkan udara mikro di bawah panel.



FAKTOR YANG MENENTUKAN

Jenis Tanaman Sayuran daun, rumput, kacang-kacangan	Kerapatan & Tinggi Tanaman < 1 m > 2 m	Ketersediaan Air < 1,5 m
Sistem Irigasi	Ketinggian Panel dari Tanah ↑ 1,5 – 2,5 meter	

Pengaruh Shading Parsial Vegetasi terhadap Mismatch Losses pada Panel Surya



FAKTOR YANG MENENTUKAN

Jenis Vegetasi • N Batjis • Tangei	Orientasi Bayangan • Sejajar Sel Melintang	Gerakan Daun • Angin Kecil • Power Fluktuasi
Topologi Sistem String Inverter (vianan) Tanah		



Isu di AgriPV

Pengembangan trainer pembelajaran



Thank You