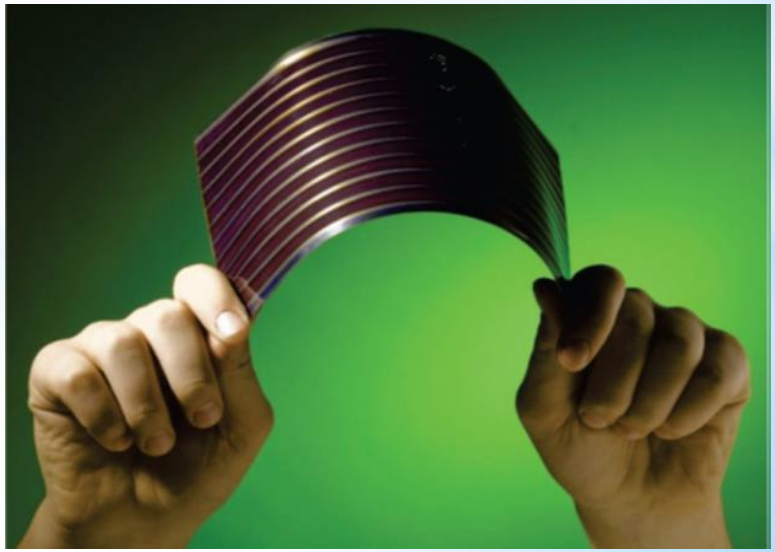
IN THE NAME OF GOD

Dye Sensitized Solar Cells



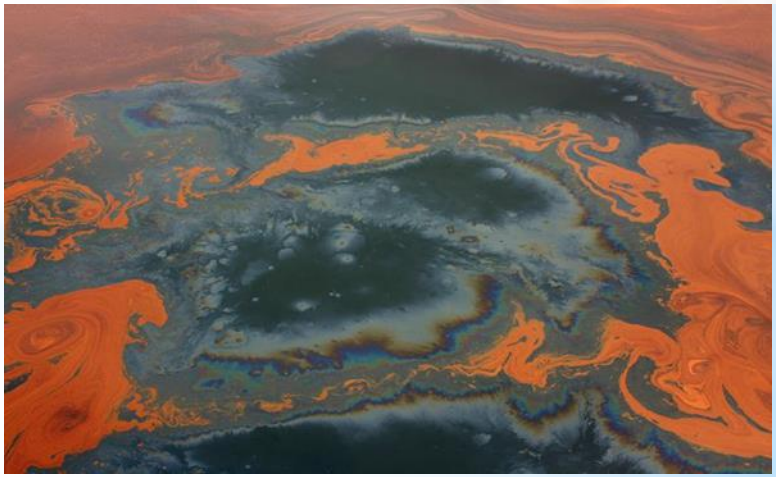
Overview:

- A brief on oil problems and alternative solutions
- DSSC’s general structure and operation
- Renaissance of DSSC’s
- Recent research (Cosensitization)
- Conclusion
- References

Oil and problems

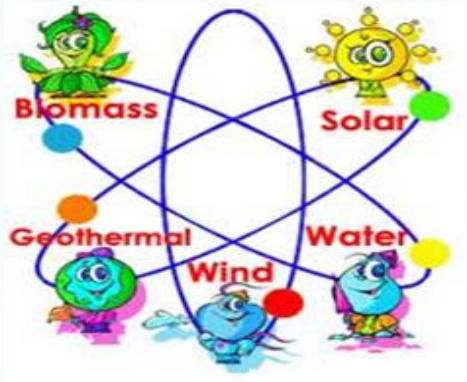
- Unbelievable price increment

- Environmental issues



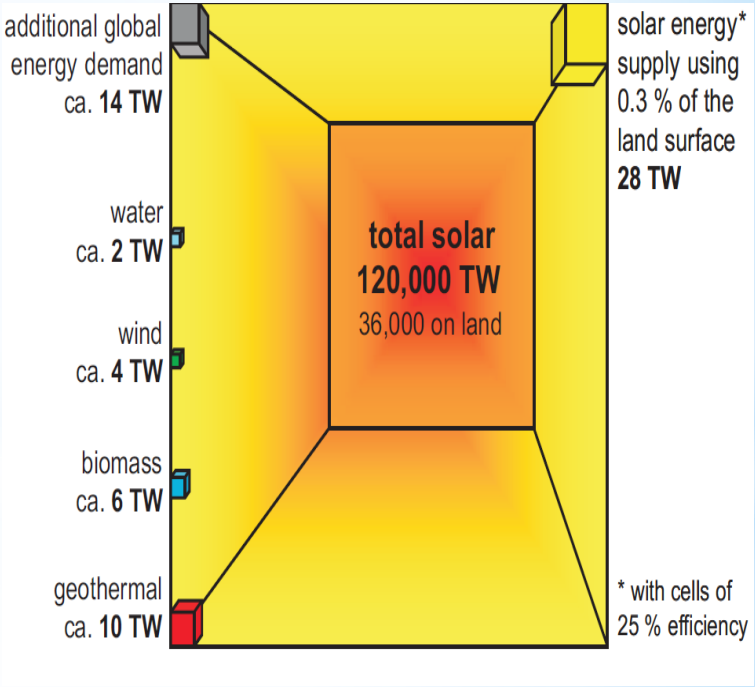
- Strategically applicable

Solution: Renewable energy resources



The merits of solar energy:

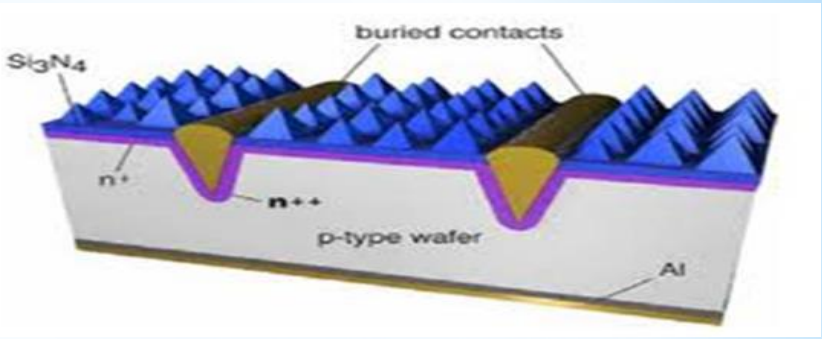
- Globally available
- High energy content
- Low cost energy production



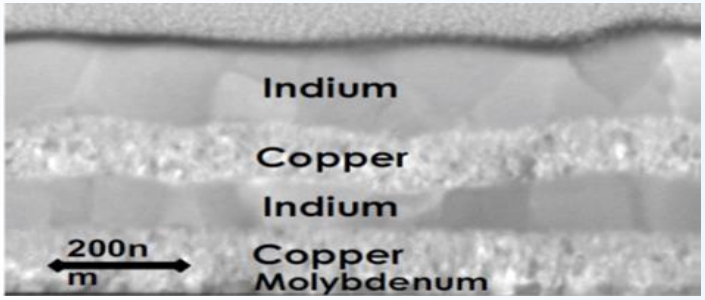
DSSC's: Structure and operation

Solar cell evolution

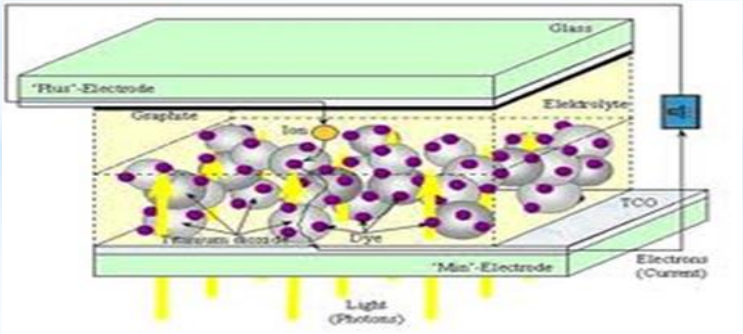
- Silicon or Germanium doped with Phosphorous or born



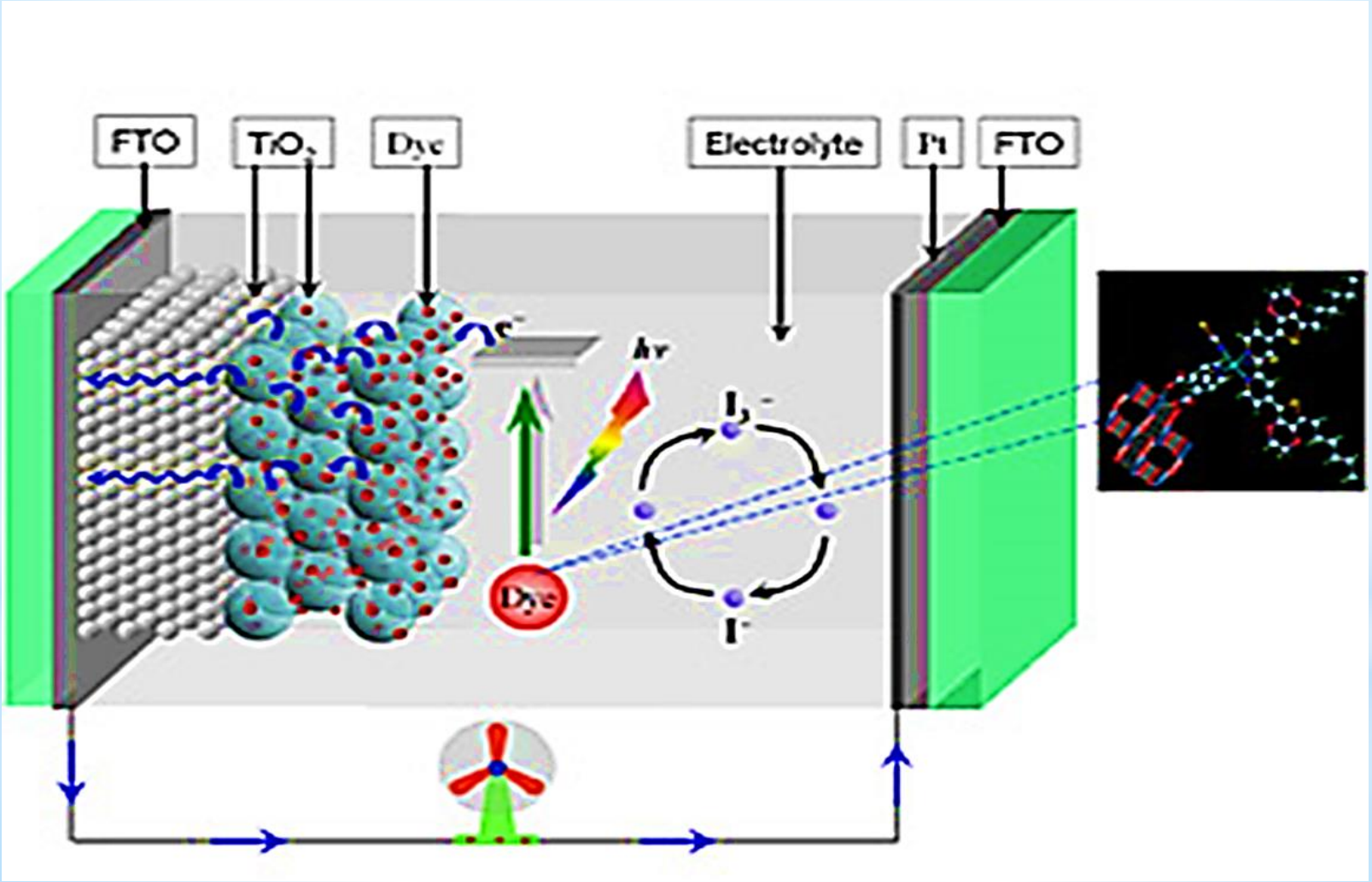
- Multi junction



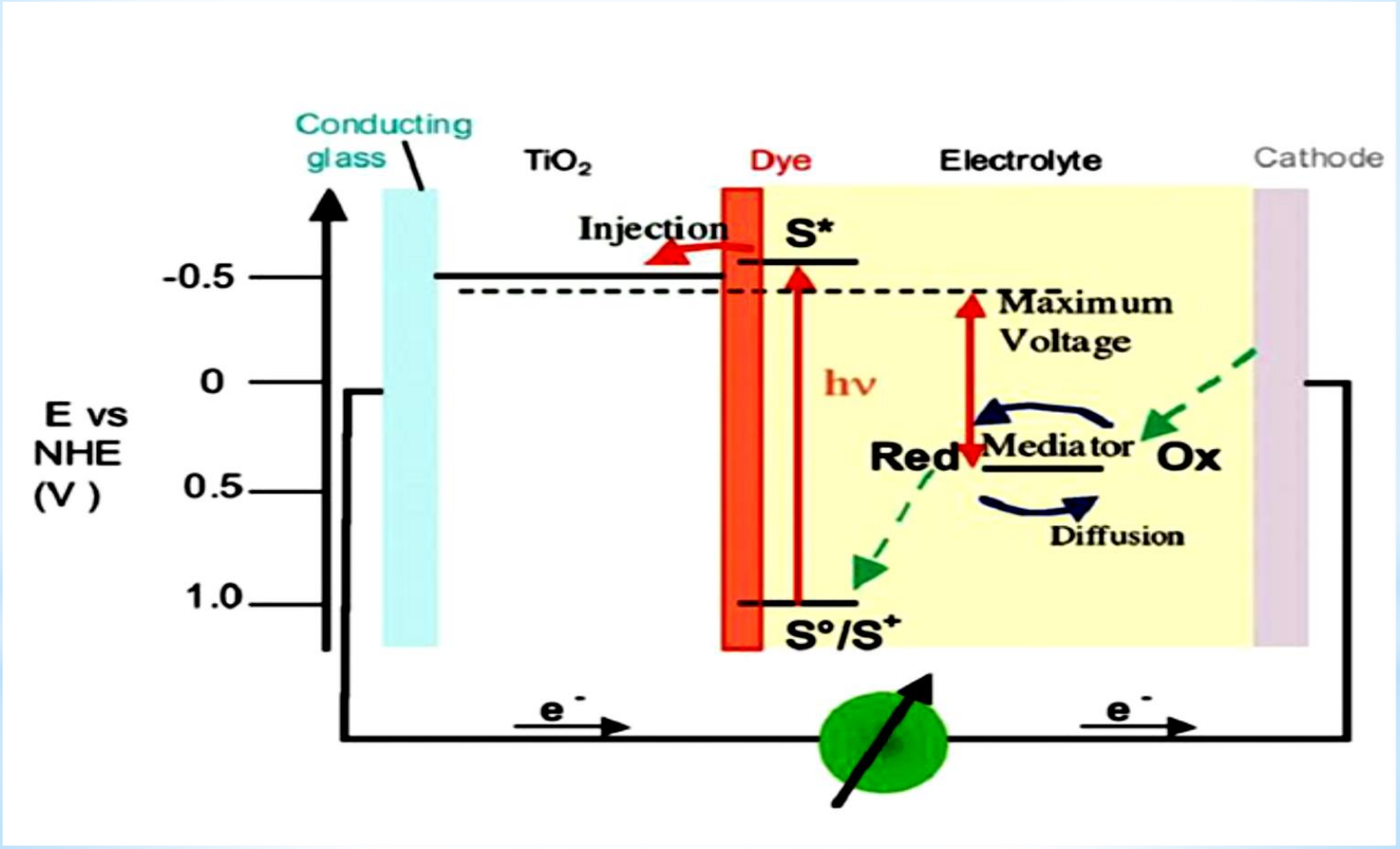
- DSSC's



General structure



General operation in DSSC's



Sensitizing dyes

Organic molecules with desirable structure for charge generation-transportation phenomenon and suitable adhesion to substrate surface.

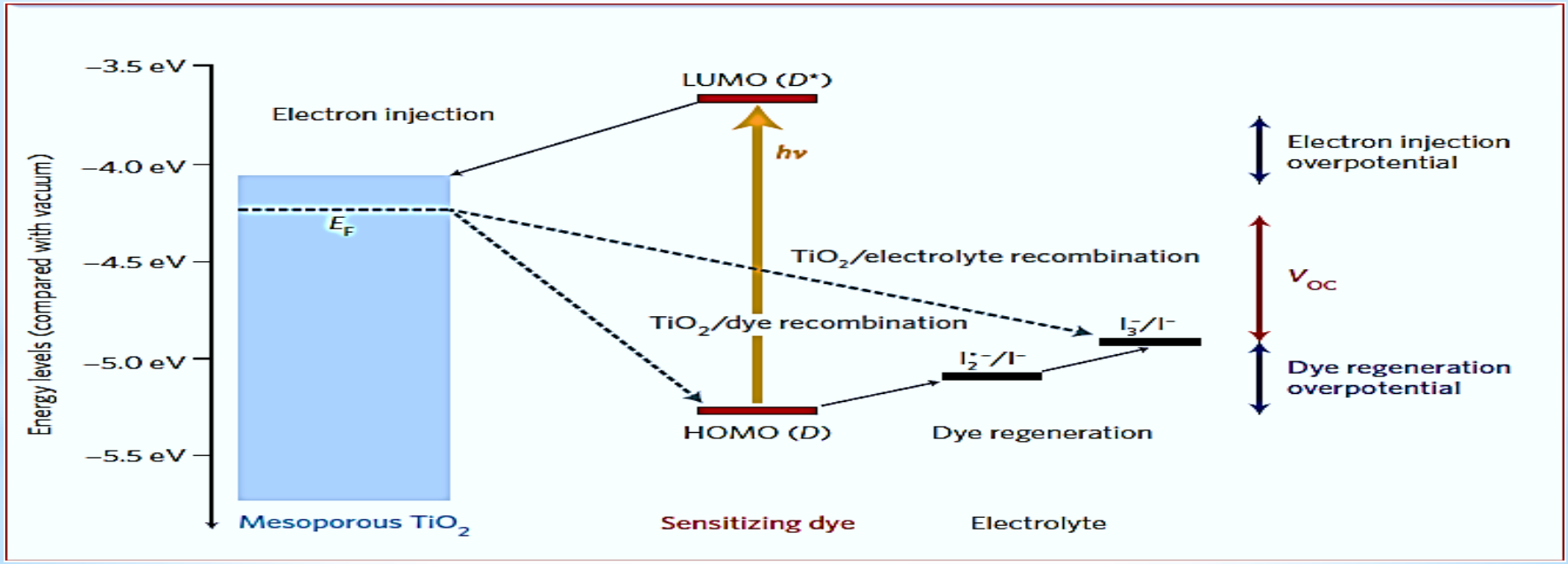
Dyes must have:

1-Light absorption in wide spectrum(whole visible and NIR in most extend)

2-Suitable anchoring groups for strong attachment onto the SM surface(COOH,…)

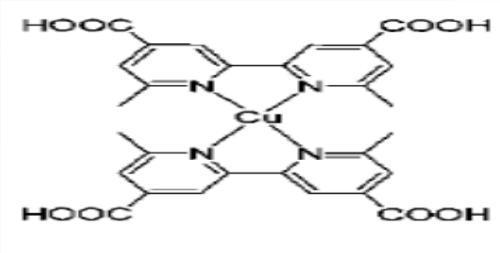
3- High stability in response to thermal, electrochemical,…… situation

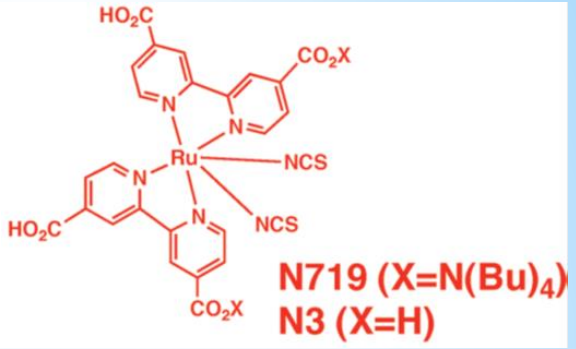
4-For efficient electron transfer the LUMO of dye should be higher than CB of SM



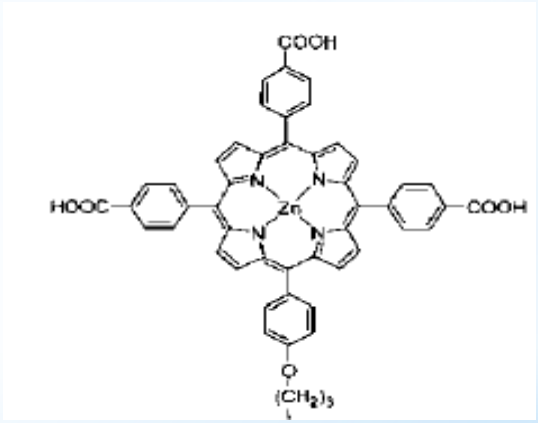
Classification:

- Metal complexes

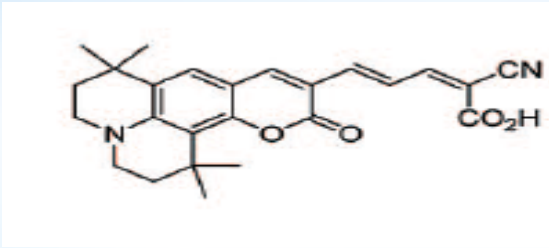


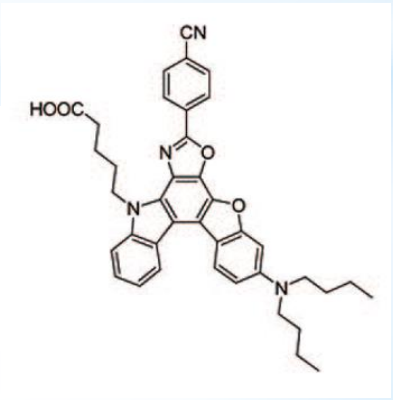


- Porphyrins and Phthalocyanines

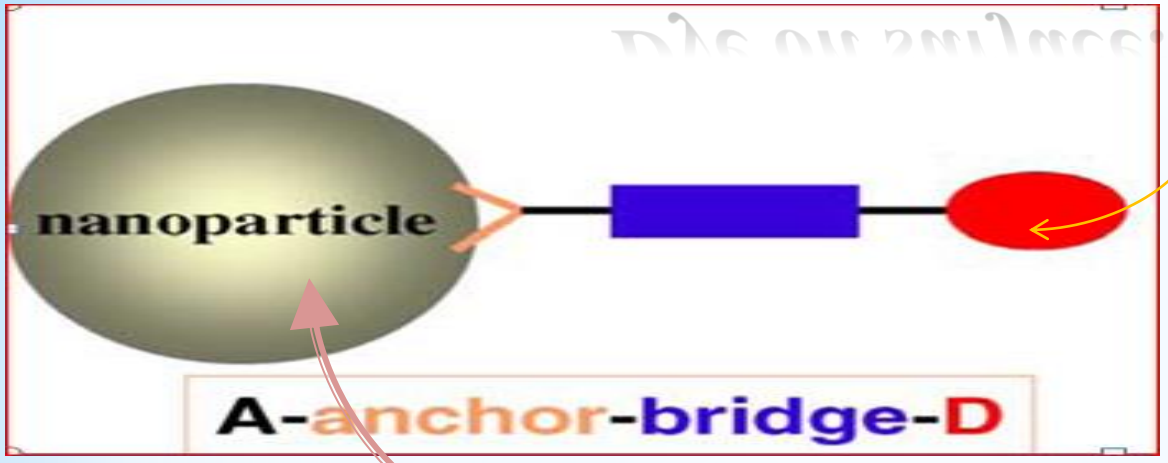


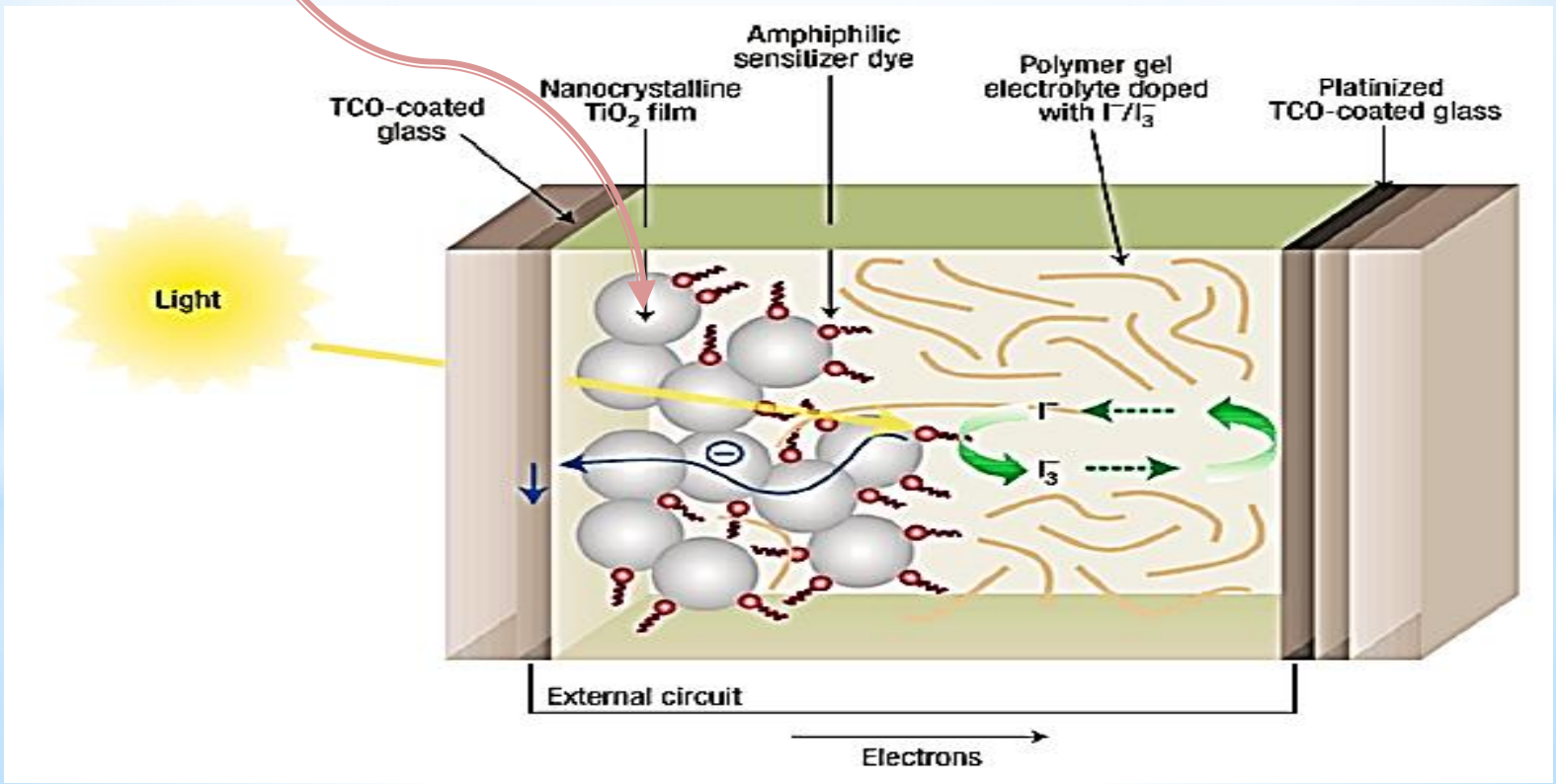
- Organic dyes



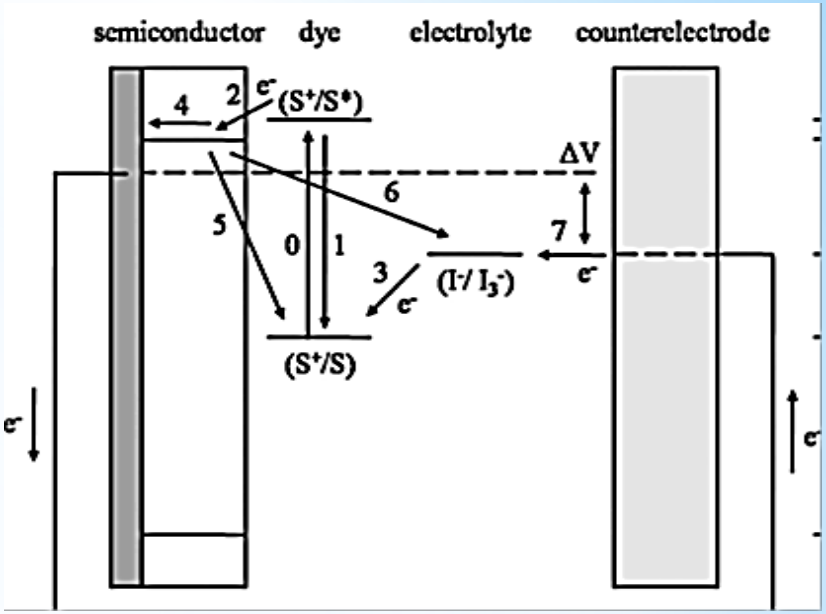


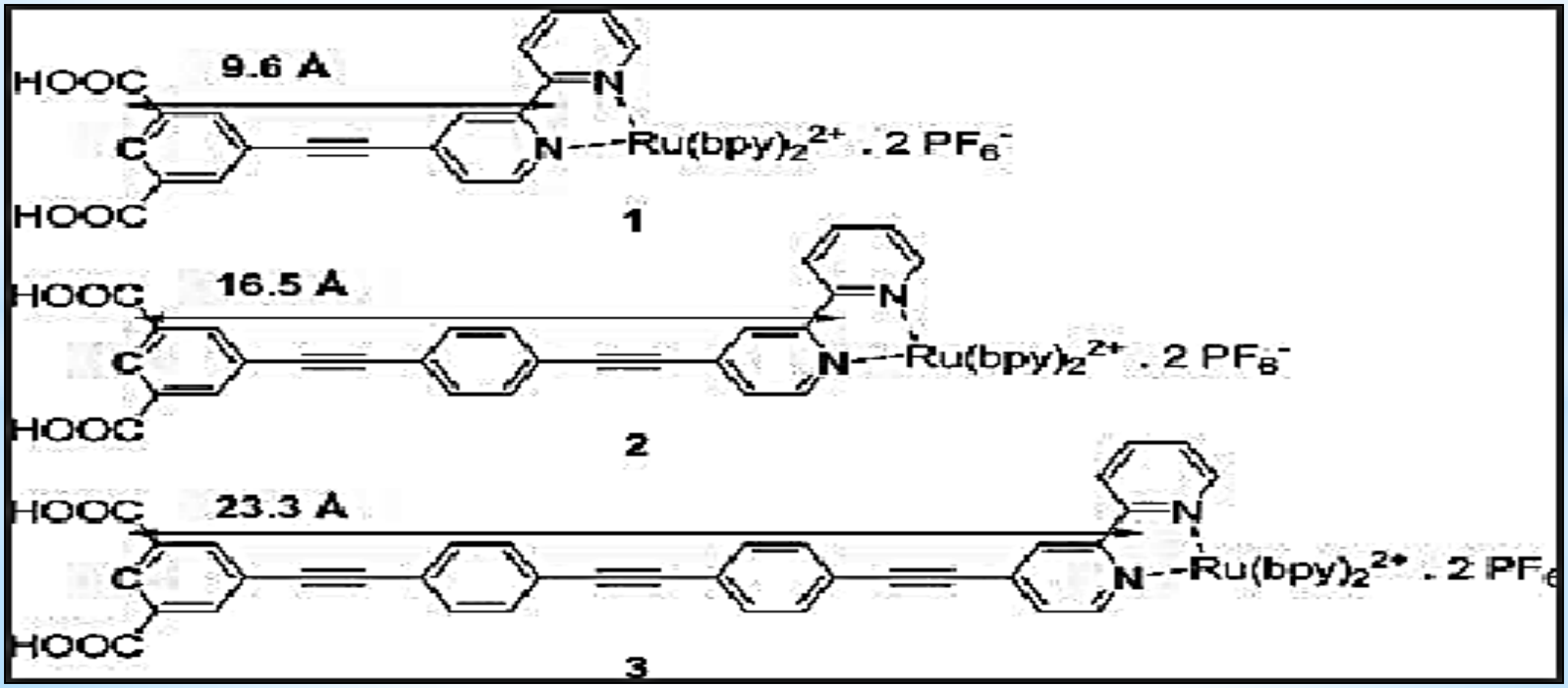
Dye on surface:





Factors playing prominent role in electron
Injection efficiency are:
1- Effect of distance
2- Electron concentration in TiO2
3- Anchoring connectors





Competing reactions

Two reactions namely 5 and 6 annihilate electrons generated in 2nd step, as the result of this net yield of electron injection staged massive decline.

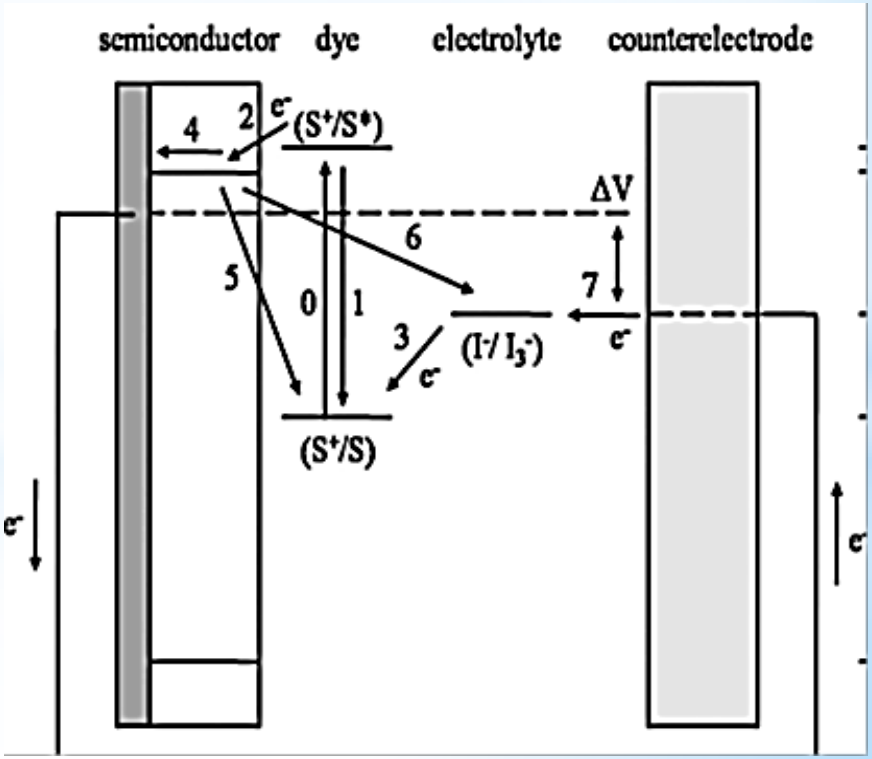
The frequent occurrence of reactions 5 and 6 determined by factors like:

1-Traps density

2- CB electron concentration

3- Proper adsorption mechanism electron donor

4- Particles size



Reduction of oxidized dye

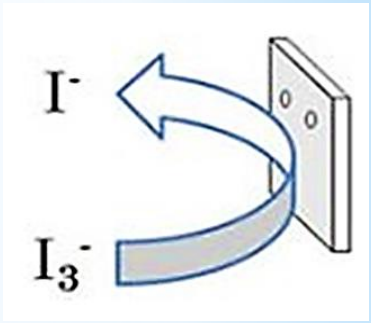
The reduction process includes:

$$S^+ + I^- \rightarrow (S\cdots I)$$

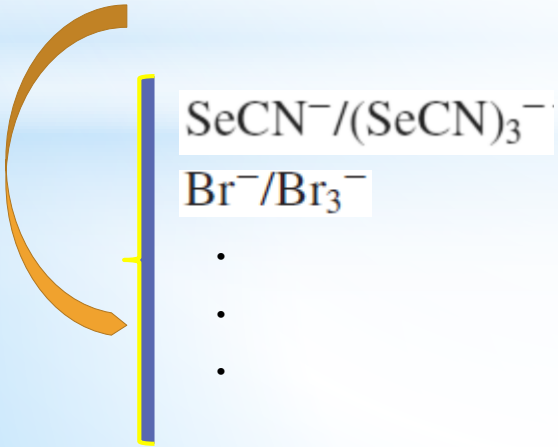
$$(S\cdots I) + I^- \rightarrow (S\cdots I_2^{-\bullet})$$

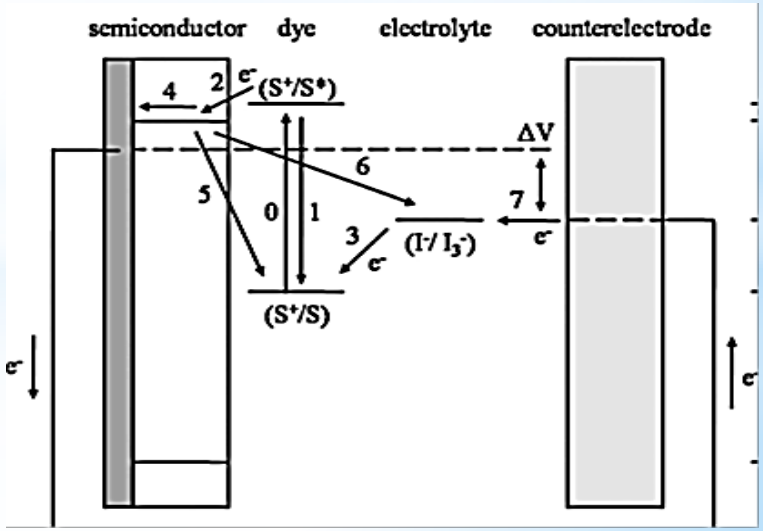
$$(S\cdots I_2^{-\bullet}) \rightarrow S + I_2^{-\bullet}$$

$$2I_2^{-\bullet} \rightarrow I_3^- + I^-$$



Some other examples
of what have been employed
as electron donor species are:

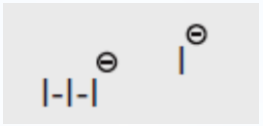


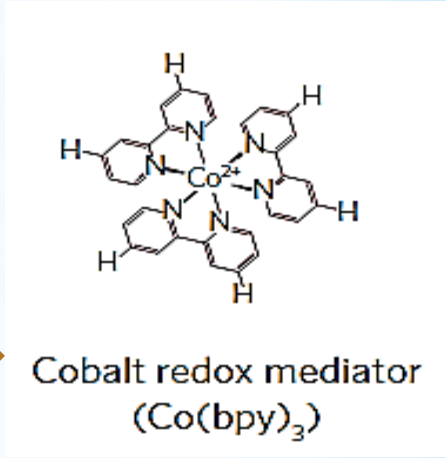


The renaissance of dye sensitized solar cell

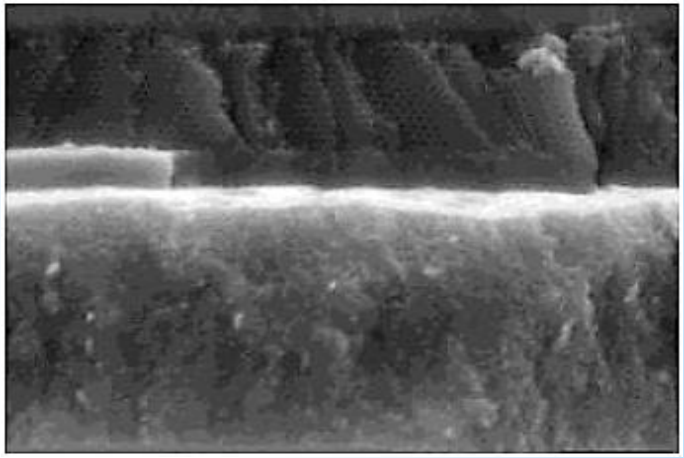
Contemporary photovoltaic technology shows drastic impairment for higher power generation, on this basis fresh approaches are demanded for greater energy production from relatively low cost materials, less toxic. For this mean newly examined measures are:

1- Application of new redox couples



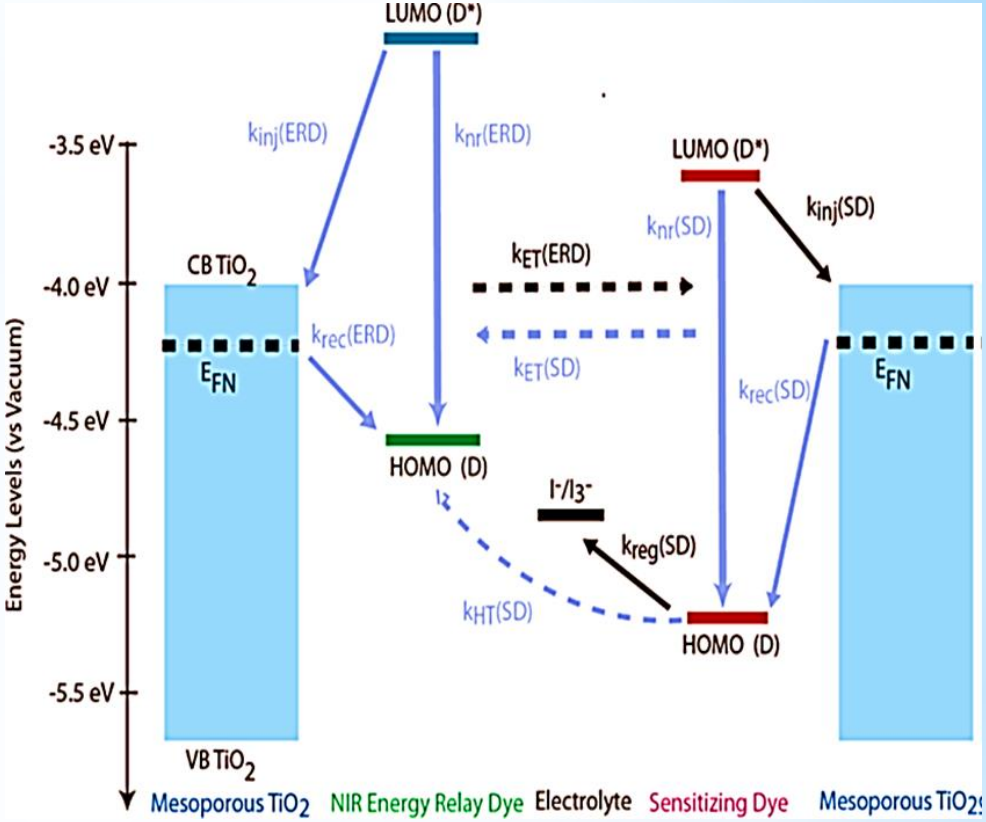


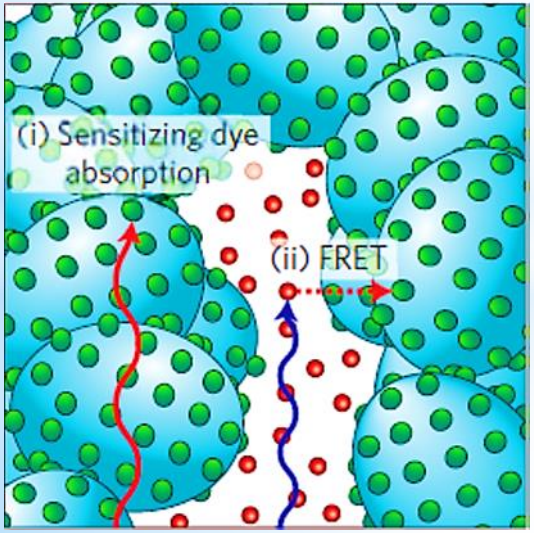
2- Light trapping methods

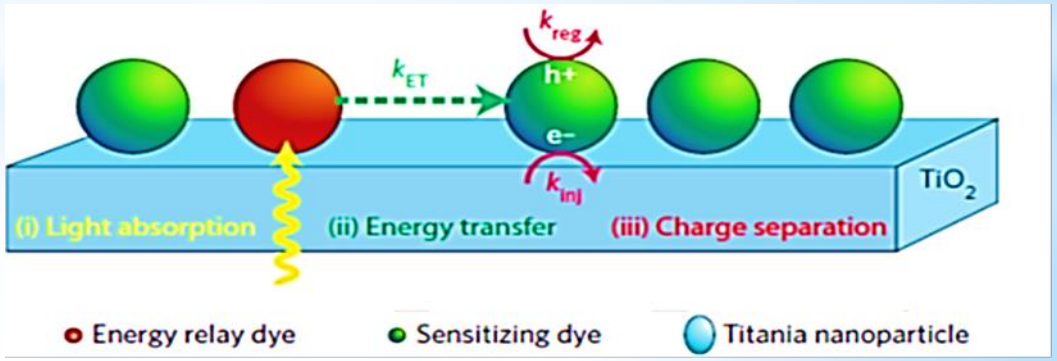


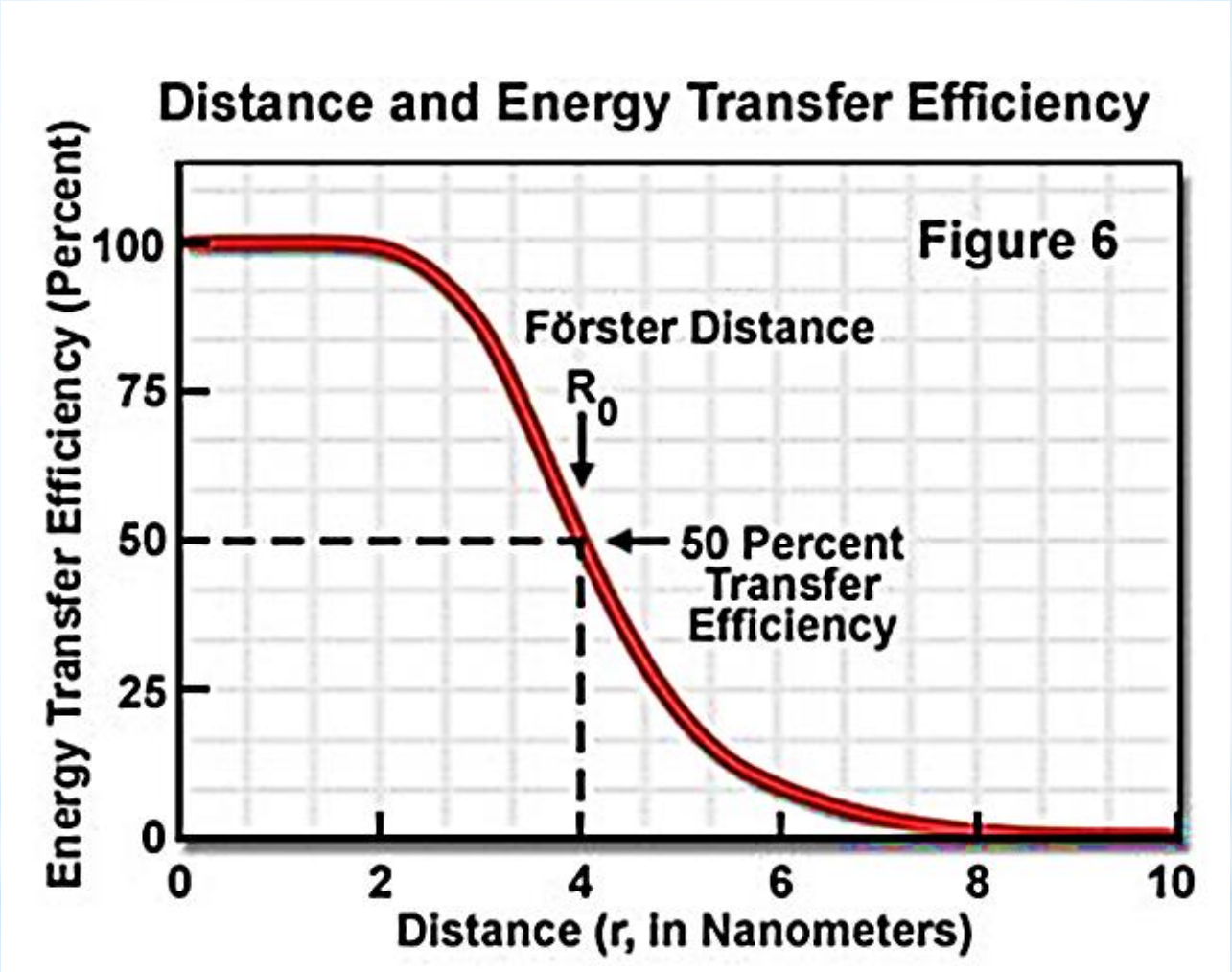
3- Co-sensitization and energy rely dyes

Jablonski diagram in Co-sensitization phenomenon.

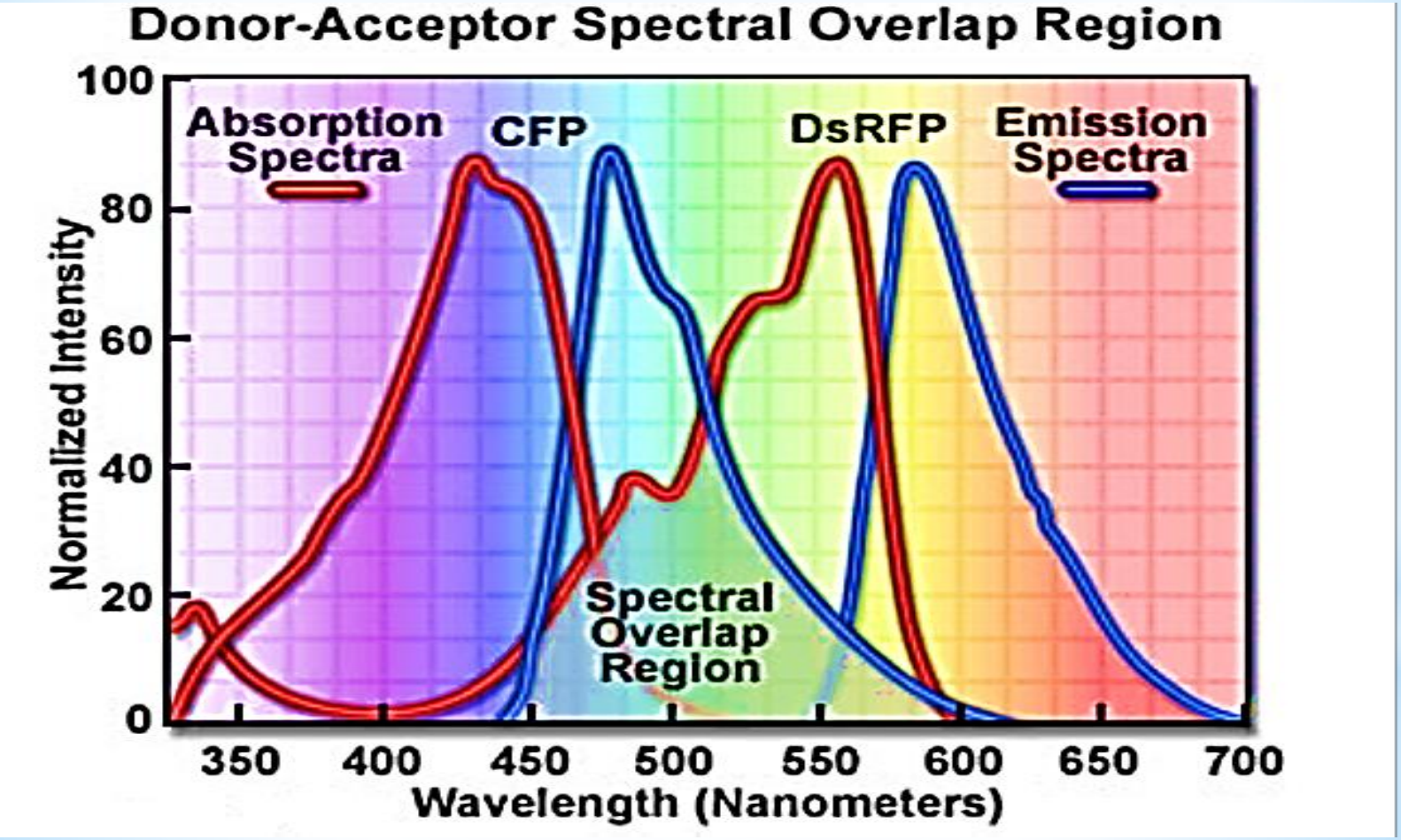







Distance and Energy Transfer Efficiency
Figure 6
Energy Transfer Efficiency (Percent)
100
75
50
25
0
Förster Distance
R_0
50 Percent
Transfer
Efficiency
0
2
4
6
8
10
Distance (r, In Nanometers)

FRET: the amazing phenomenon



Conclusion:

Massive energy generation is an inevitable demand of our current era and it's significance is inconceivable fact with respect to our global energy consumption. Due to the reviewed problems with oil, scientists were had to take an initiatives roadmap to extract energy from other sources.

In this regard several approaches have been implemented and scrutinized but solar energy seems more promising for huge energy production.

During the 3 generations of evolution and development now efficiency of energy generation from solar panels has reached 12.5% which require significant technological jump for 25% energy production efficiency.

Much distance has remained until that day but is shrinking by the tireless effort of those who fully believe to the power of science and importance of knowledge.

References

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Thanks for your attention