

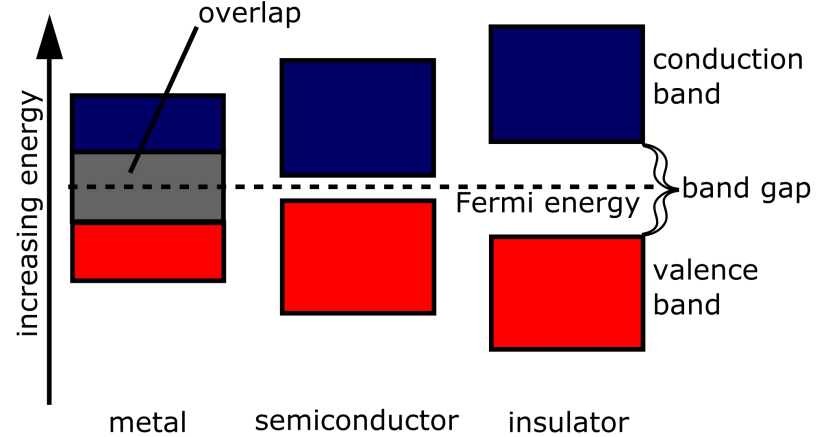
Going Beyond the Shockley-Queisser Limit

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Summer 2021
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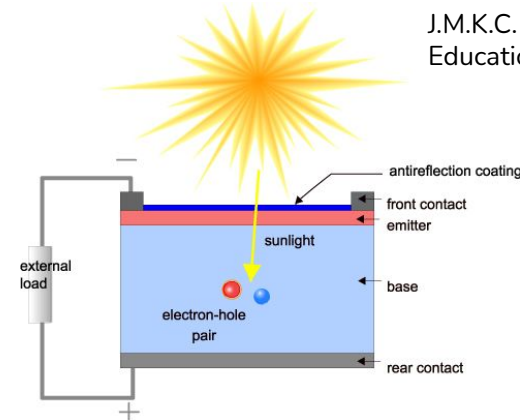


Solar Cell Operation

- Photosensitive Diode
- Semiconductors most often used
- Band gap theory
- Forbidden region
- Completing the circuit

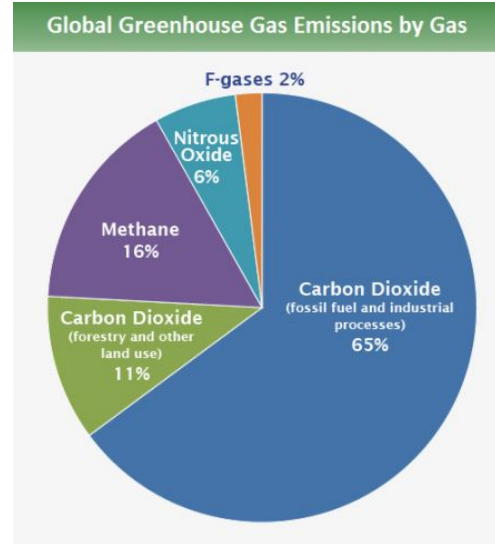


J.M.K.C. Donev et al. (2015). Energy Education - Band gap [Online].

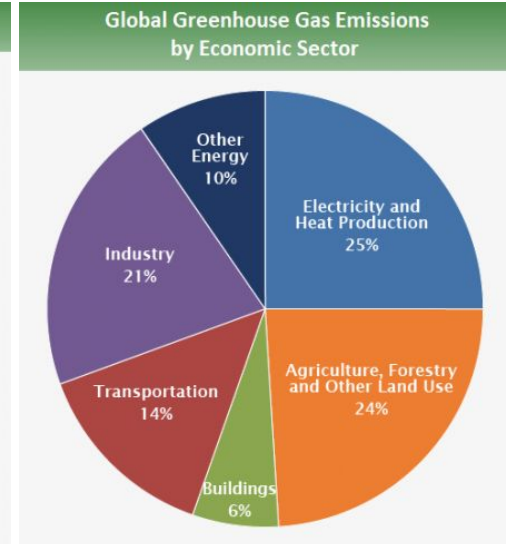


Motivations

- Sources of sustainable energy
- Climate change
- Material costs
- Better understanding of underlying theory



IPCC (2014)

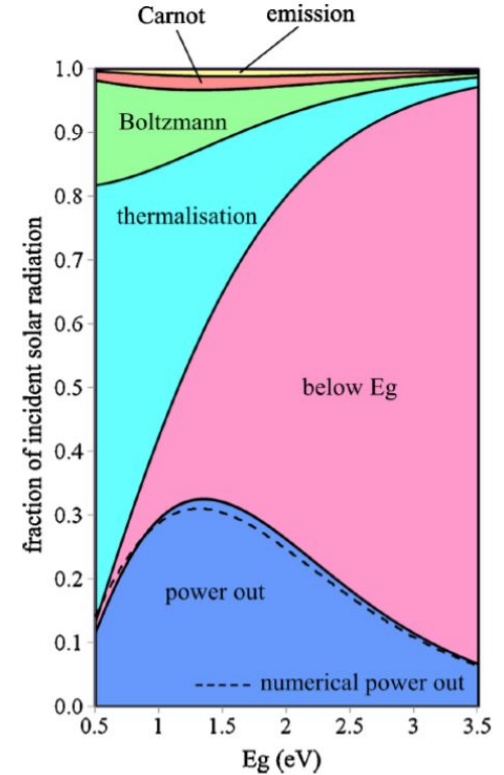


IPCC (2014)



The Shockley-Queisser Limit

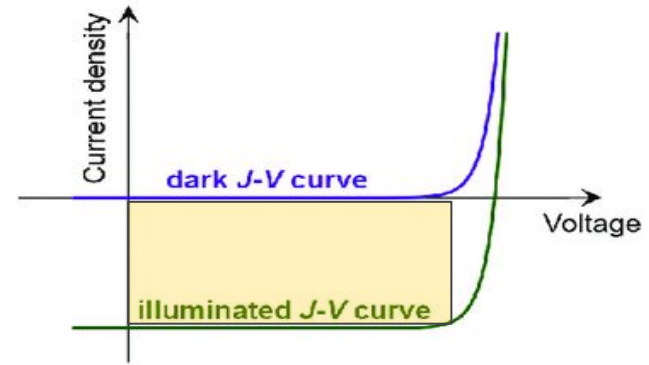
- Solar cells can only be so efficient
- 33.7% Maximum
- Hot Carrier Photovoltaic Cells
- The five intrinsic losses
- Thermalization



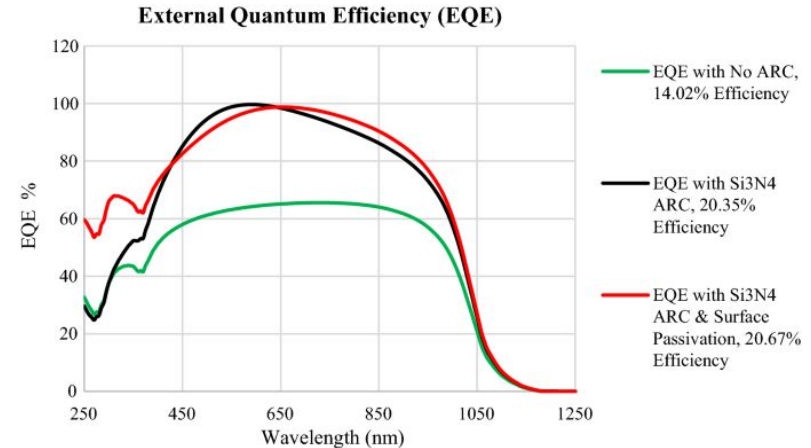
Hirst, L.C. and N.J. Ekins

Personal Research - JV Curves

- Current density vs. Potential Difference
- Dark and light measurements
- Obtain efficiencies
- EQE Measurements
- Wavelength efficiency



Y. Tao

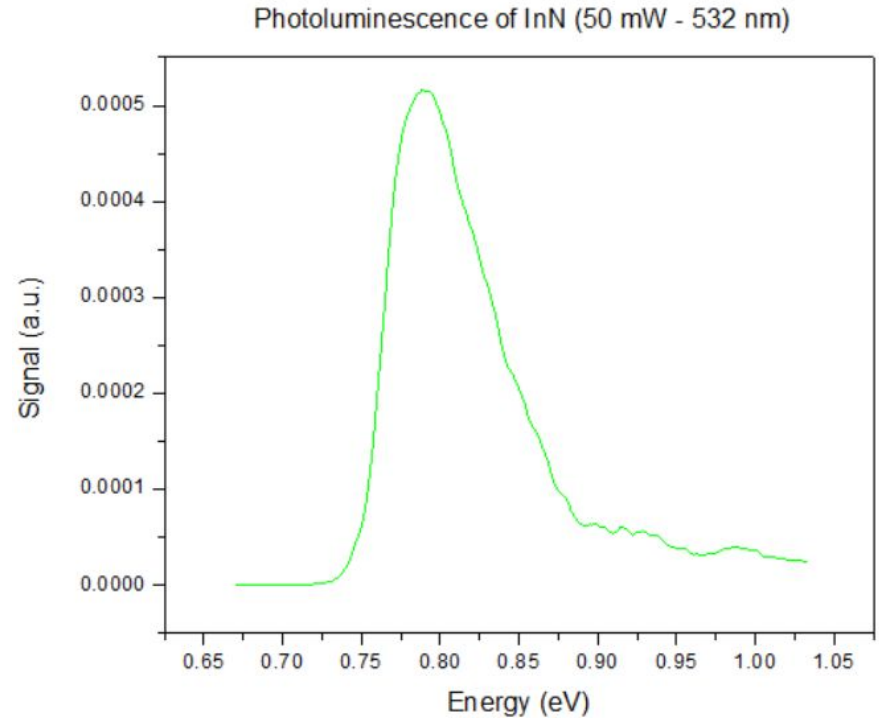


G. Hashmi, M. Rashid, Z. Mahmood, et al.

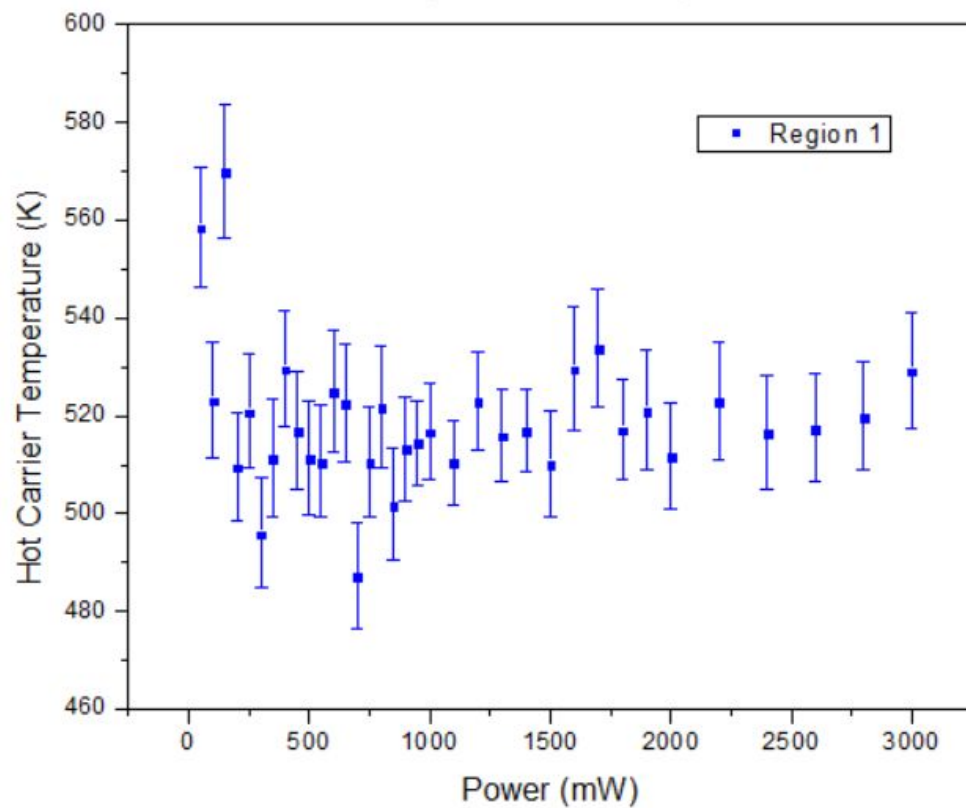


Personal Research - PL Measurements

- Photoluminescence
- Band gap size
- Indium Nitride (InN)
- Power and Temperature
- Assessing hot carrier absorbers



InN - Region 1 - Power Dependence



The background is a solid orange color. In the top-left corner, there are three vertical bars of varying heights, each composed of three overlapping circles. In the bottom-right corner, there are four vertical bars of varying heights, each composed of three overlapping circles.

Any Questions?