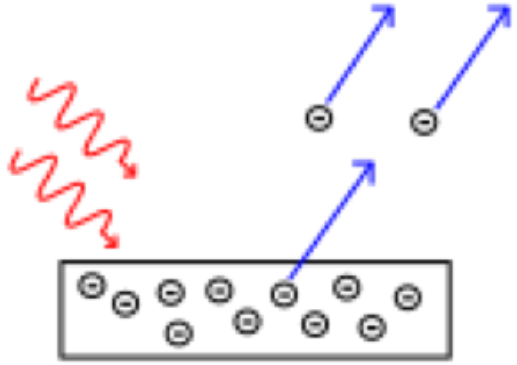
EE49
Lecture

Tuesday Feb 13, 2018

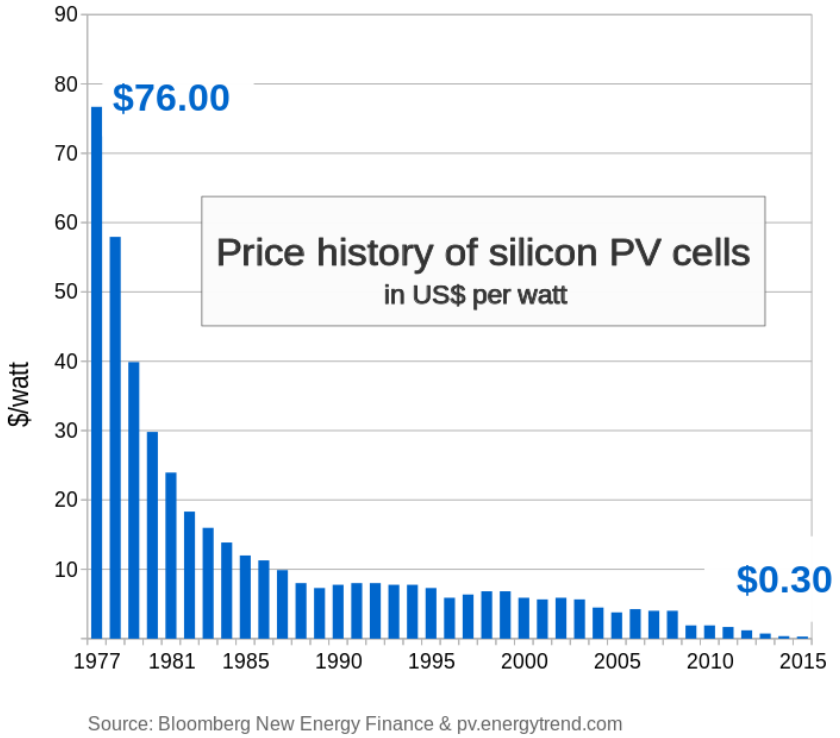
Photoelectric Effect



- Emission of electron when light strikes a material
- Classical theory
  - More intense light will cause more energetic electrons
  - Experimentally false
- Quantum theory
  - Energy = h\nu
  - Need certain energy threshold (of min frequency) to emit electrons
  - Lower intensity means fewer photons means less current, not more energetic electrons

Solar Cells

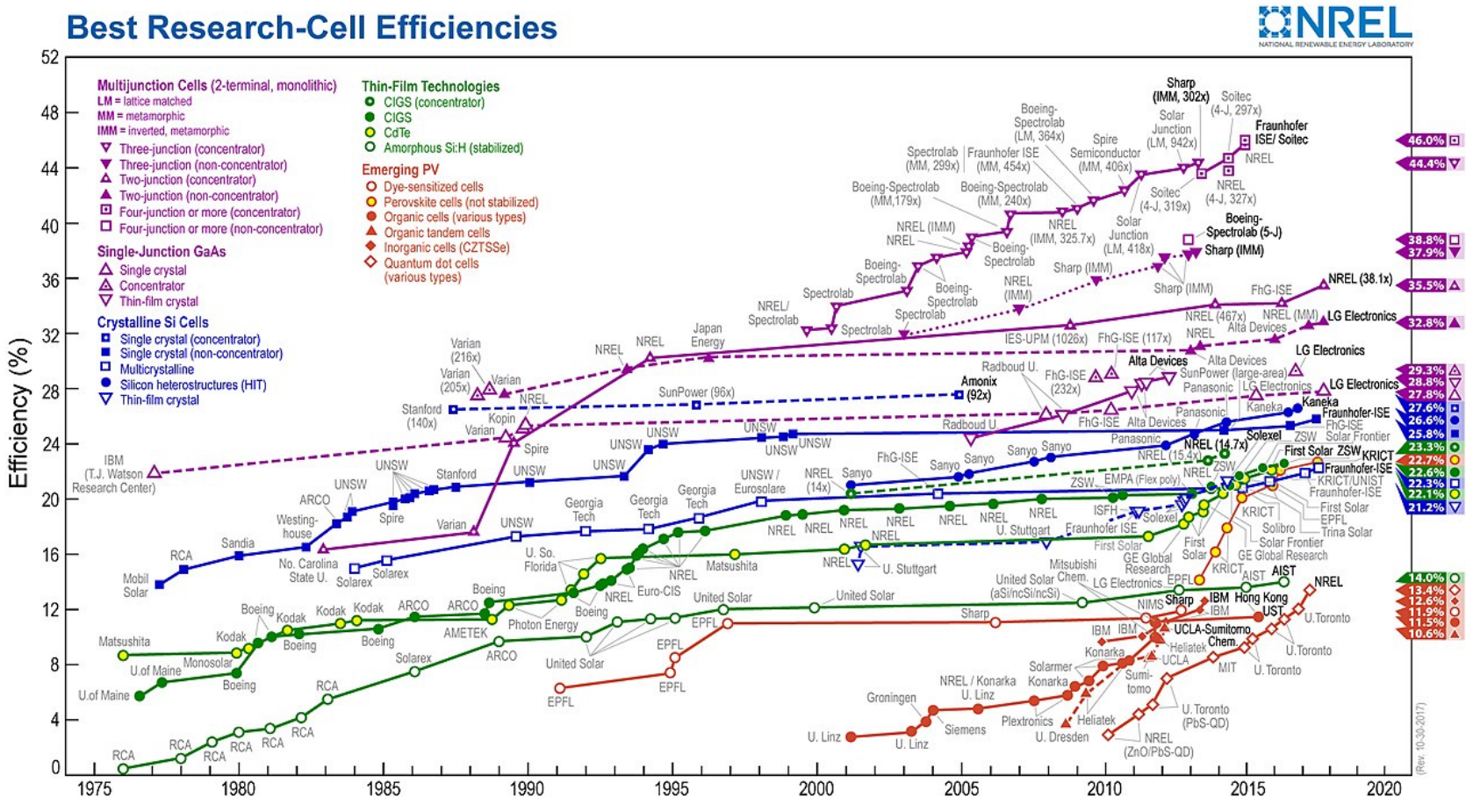
- Engineered materials to produce significant useful currents
  - Si, other semiconductor materials, Perovskites, etc
- Costs have decreased a lot



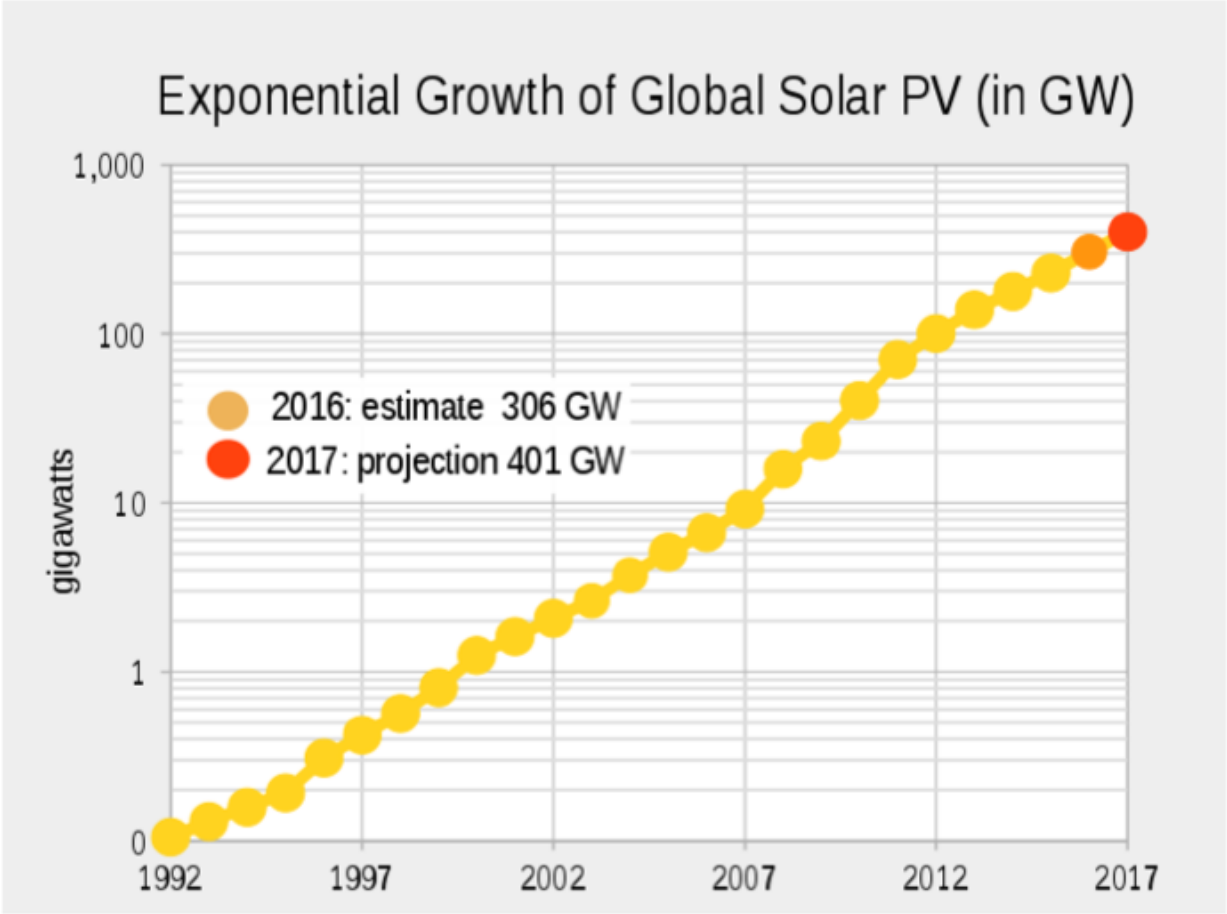
Source: Bloomberg New Energy Finance & pv.energytrend.com

Efficiency

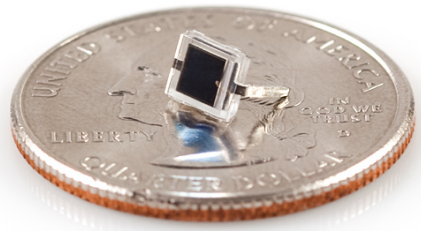
- Efficiencies have increased a lot
- > 30% now
- Near theoretic limits



Explosion of growth!



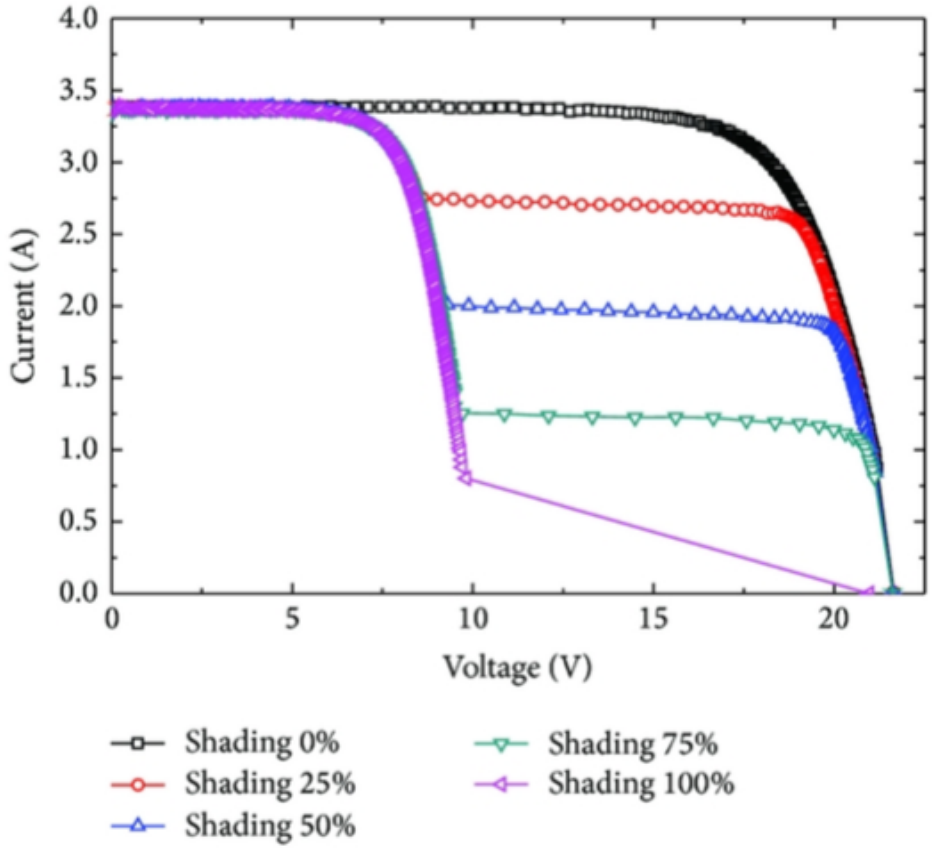
EE49 IOT



- Solar cells in IOT
- To power electronics, microprocessors, etc
- Remote sensing, device control, …
- Need backup battery or capacitor, so ckt works even when dark

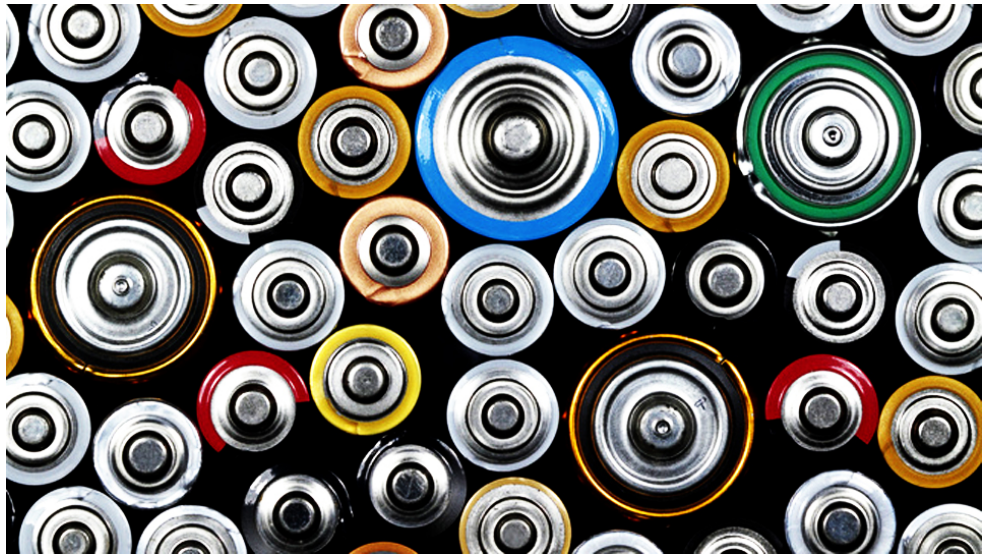
  (for some time)

I-V curves of Solar Cells

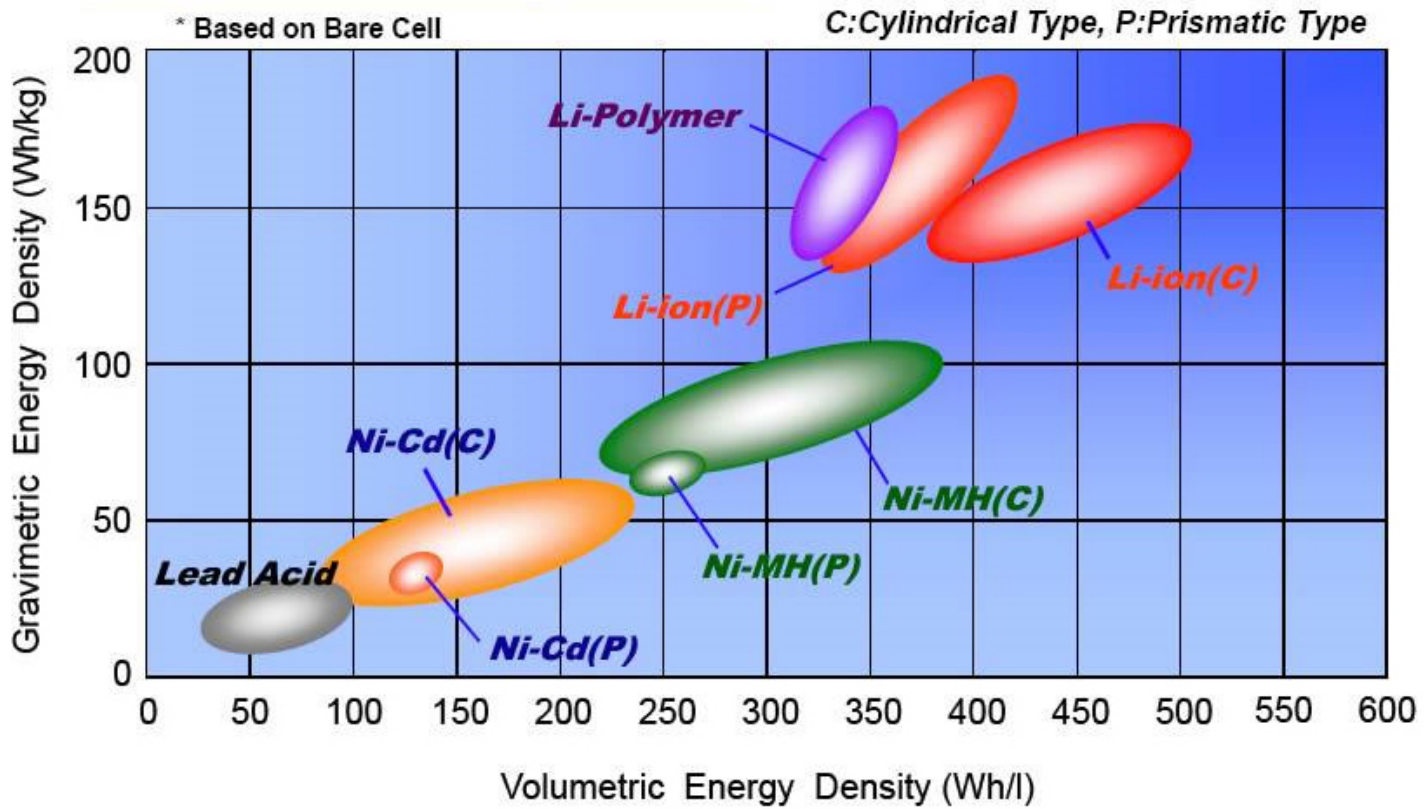


Batteries

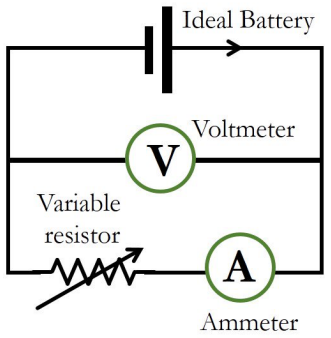
- Essential for IOT
- Many options
  - Footprint, weight
  - Operating range
  - Cost
  - Voltage, power
  - Capacity
  - Lifetime
  - Charging characteristics
  - Efficiency, leakage

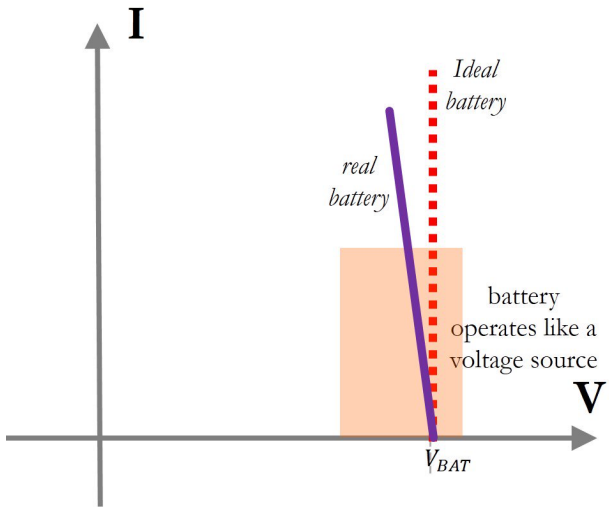


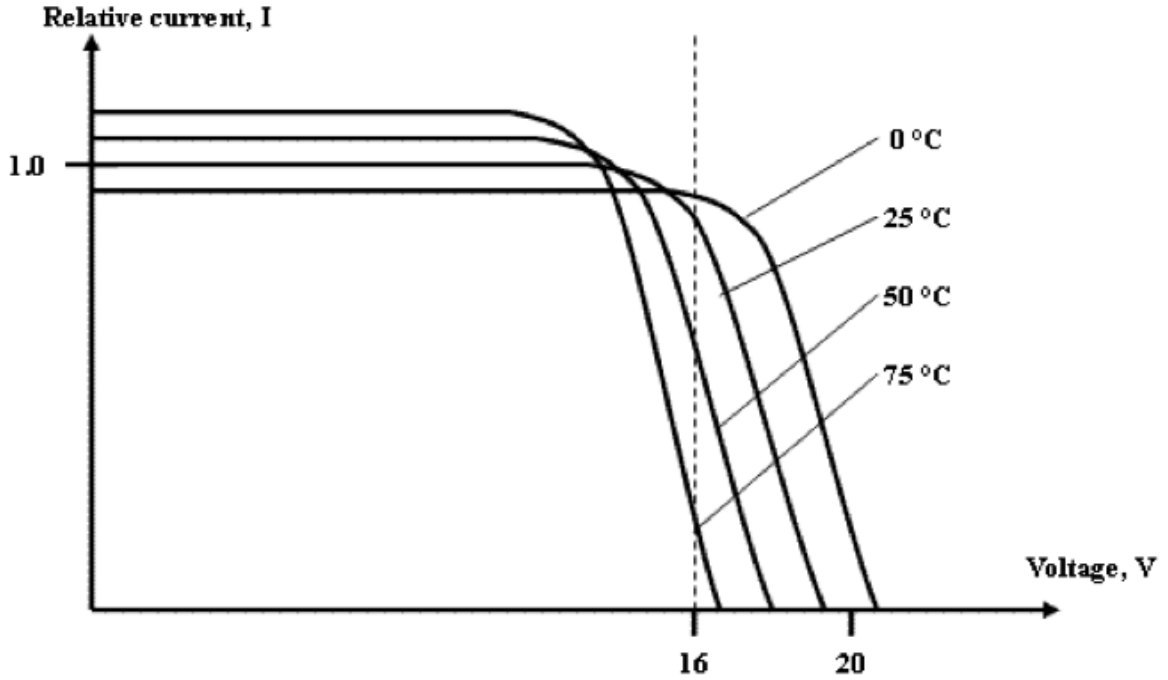
Energy Density



Battery I-V curves







Now to the Blackboard

- Ideal Voltage source model
- Ideal Current source model
- Real battery model
- Internal resistance
- Load resistance
- Energy and Power
- Maximum power transfer
- Solar Cell Model