Solar Voltaic Energy

By Garrett Rudolfs

Also known as Photovoltaic

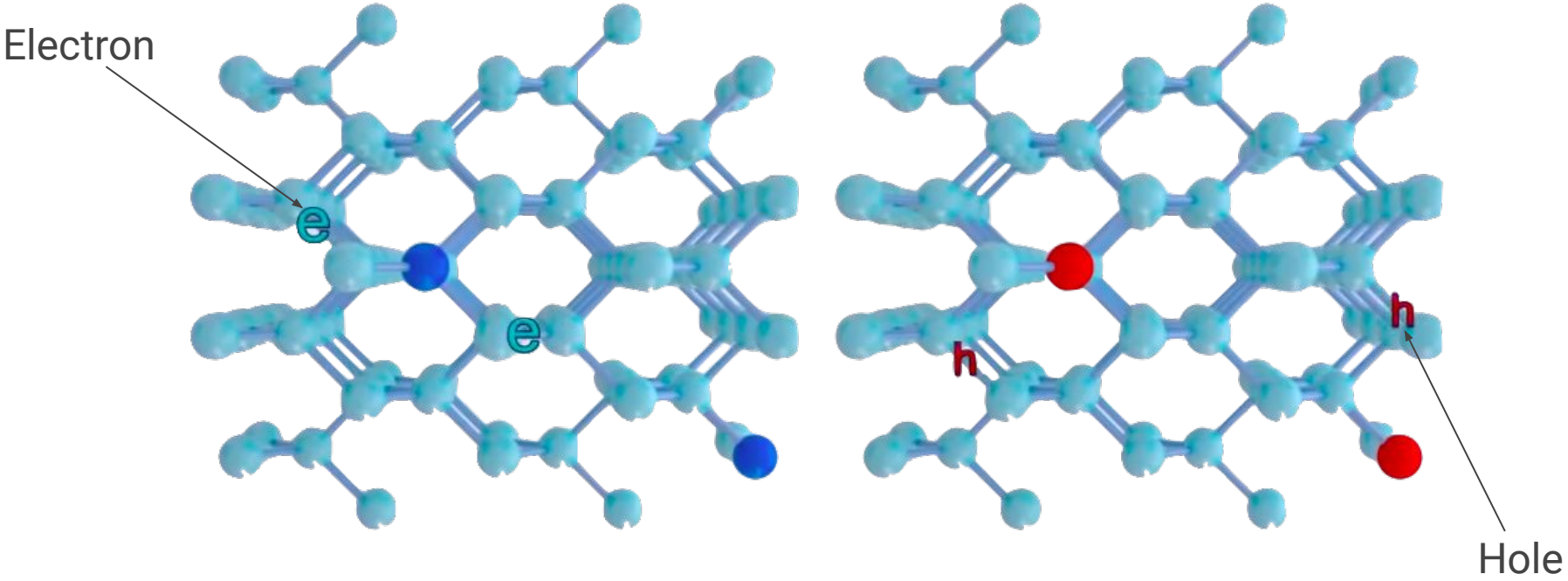
- The term "photovoltaic" comes from the Greek φῶς (phōs) meaning "light", and from "volt"
- What this word means in english is something of or relating to the Photovoltaic effect
- So what is this effect?

Photovoltaic effect

The phenomenon in which the incidence of light or other electromagnetic radiation upon the junction of two dissimilar materials, as a metal and a semiconductor, induces the generation of an electromotive force.

In other words:

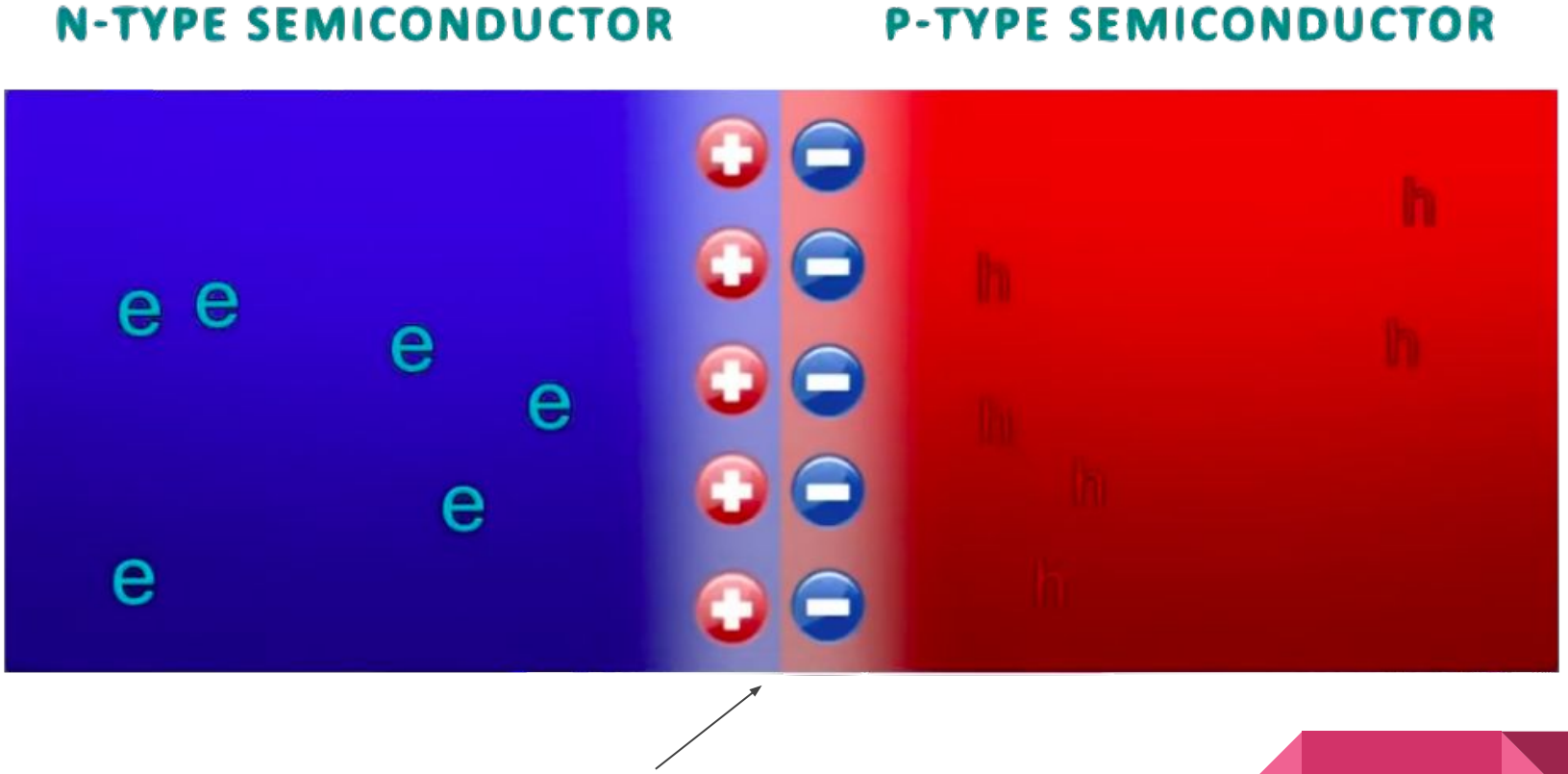
- First we start with a semiconductor, like Silicon
- Then we do a process called Doping
- Doping is when you add impurity atoms to the semiconductor to increase it’s conductivity
- Impurity atoms are atoms that cause the semiconductor to become either N-type or P-type
- This is through the amount of electrons the atom has
- An atom with more electrons than Silicon produces a N-type, while less electrons would result in a P-type



This is a diagram of Doping

PN-Junction

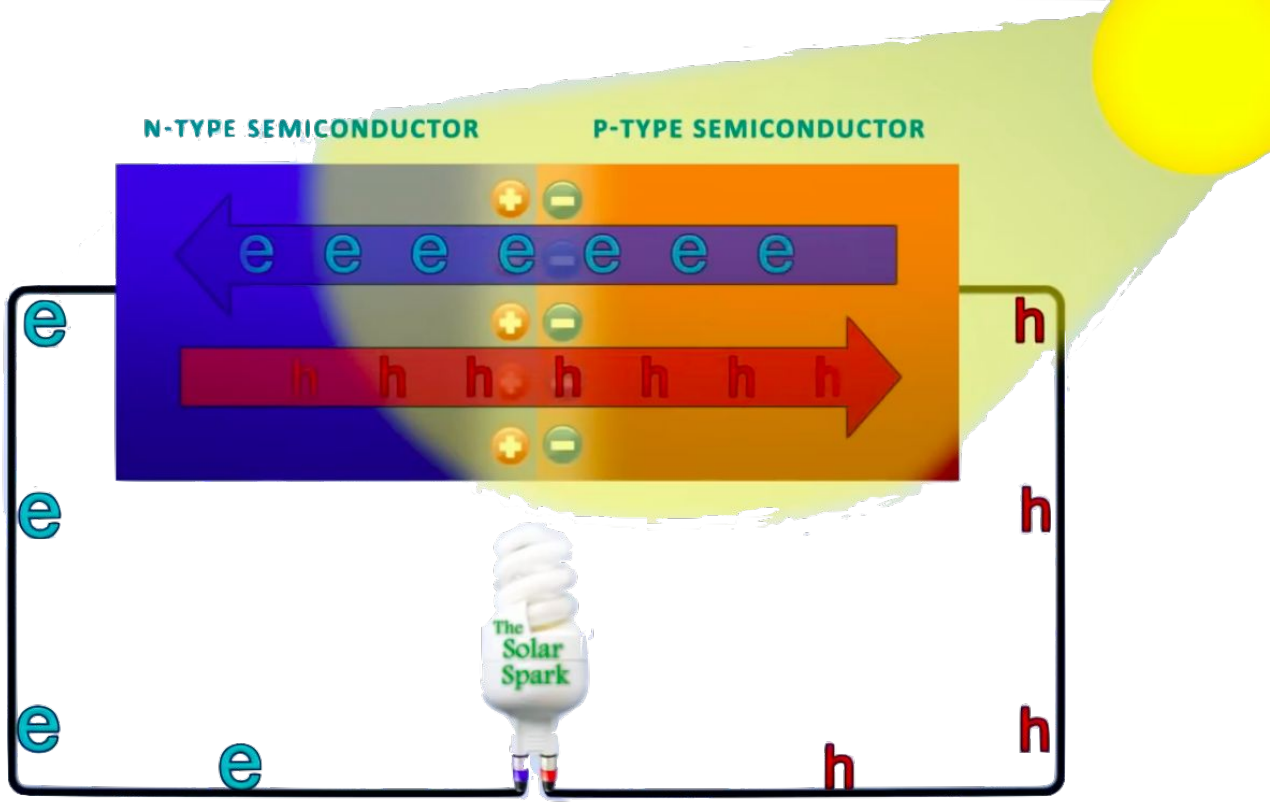
- A PN-Junction is created when you bring a N-type and P-type semiconductor together
- When Electrons cross over the Junction, they leave behind a static positive charge
- At the same time the holes cross, they also leave behind statice energy, but this kind is negative
- When a hole and an electron meet up, they both disappear
- This also creates a zone in the PN-Junction called the Depletion Zone, this is where there are no charge carriers anymore
- This results in an electric field across the Depletion Zone



Depletion Zone

So what does this have to do with solar energy?

- When energy from light is absorbed by the Semiconductor, it will dislodge an electron
- This creates an extra mobile Electron and an extra mobile hole
- The Electric Field makes the mobile Electron flow to the N-type, while the mobile hole flows towards the P-type
- This whole process is known as Photogeneration of Charge Carriers
- This process can occur throughout the N and P-type semiconductors
- In the end, this results in a potential difference or voltage from the positive and negative charges being spread throughout the junction



If you were to connect the junction to a circuit, the charges driven around the circuit forms an electric current. This allows us to power things, like light bulbs.

How Important Is This Source of Energy?

Well...

- It’s Clean Energy, the Energy comes from the Sun, not coal or Oil
- It is the third renewable energy source in terms of globally capacity
- In 2014, it’s capacity was upgraded worldwide to 177 Gigawatts (This is 2% of the global electricity demand)
- It’s being used in Telecommunication and signaling and Spacecraft applications

How Accessible Is This Source of Energy

Currently there are...

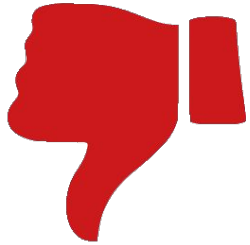
- Rooftop and building integrated systems
- Concentrator photovoltaics
- Photovoltaic thermal hybrid solar collector
- Power stations
- Rural electrification
- Standalone systems
- Floatovoltaics

Pros and Cons

Pros:

- Clean energy. No combustion. No greenhouse gas emission from use.
- Inexhaustible and abundant “fuel” supply
- Available nearly everywhere
- Well suited for distribution generation
- Technology exists today and is rapidly improving
- Generates electricity directly from sunlight
- No moving parts required
- Power generation is silent. No noise or pollution.
- Little or no transmission required
- Matches up well with air-conditioning need
- Require minimal maintenance
- Grants and incentives are sometimes available
- Excess heat can be used for co-generation

Cons:



- Expensive (Thought the prices has fallen in the last couple of years)
- It isn’t the most efficient way of collecting energy (Can’t collect energy at night)
- Requires an inverter to produce an AC current
- Needs a lot of open space to collect energy
- It is possible a better unit may come out the following year
- Low intensity (~8-12 m2/ kW)
- Possible aesthetic issues
- Fragile materials

Conclusion

Though it may not be the most efficient way to create energy, it is one of least harmful for the Earth. It is quite affordable and I hope one day will increase from 2% to much larger number.

Sources

- http://www.seia.org/policy/solar-technology/photovoltaic-solar-electric
- http://www.triplepundit.com/special/energy-options-pros-and-cons/solar-photovoltaics-pros-cons/
- http://www.dictionary.com/browse/photovoltaic
- http://www.dictionary.com/browse/photovoltaic-effect
- https://www.youtube.com/watch?v=meuCvWUV00I
- https://en.wikipedia.org/wiki/Photovoltaics
- https://spaceplace.nasa.gov/templates/featured/sun/sunburn300.png
- http://img.clipartall.com/up-thumbs-middot-2014-clipartall-com-about-terms-thumbs-up-thumbs-down-clipart-572_368.gif