



Environmental Impacts of Technology

The Production of Electricity *Power from the Sun*



Image Source: ChristofferRiemer



Image Source: Richard Gifford from Sydney, Australia

Solar Power

Production of Electricity from the Sun

Method #1:

Photovoltaic (Solar) Panels convert sunshine directly into Electricity either in a central power plant or on individual rooftops. PV Solar Energy is the most popular approach to producing electricity from the sun.



Image Source: ChristofferRiemer

Method #2:

Solar thermal plants concentrate sunlight, and produce steam which in turn produces electricity. Solar thermal plants are more expensive than PV panels and are much more sensitive to cloud cover than PV panels. They make up less than 5% of total generation of electricity from solar energy in the world.



Image Source: Bkwcreator

Solar Power

How does it work?

Method #1: Photovoltaic (PV)

Image Source: <http://eco2solar.co.uk>

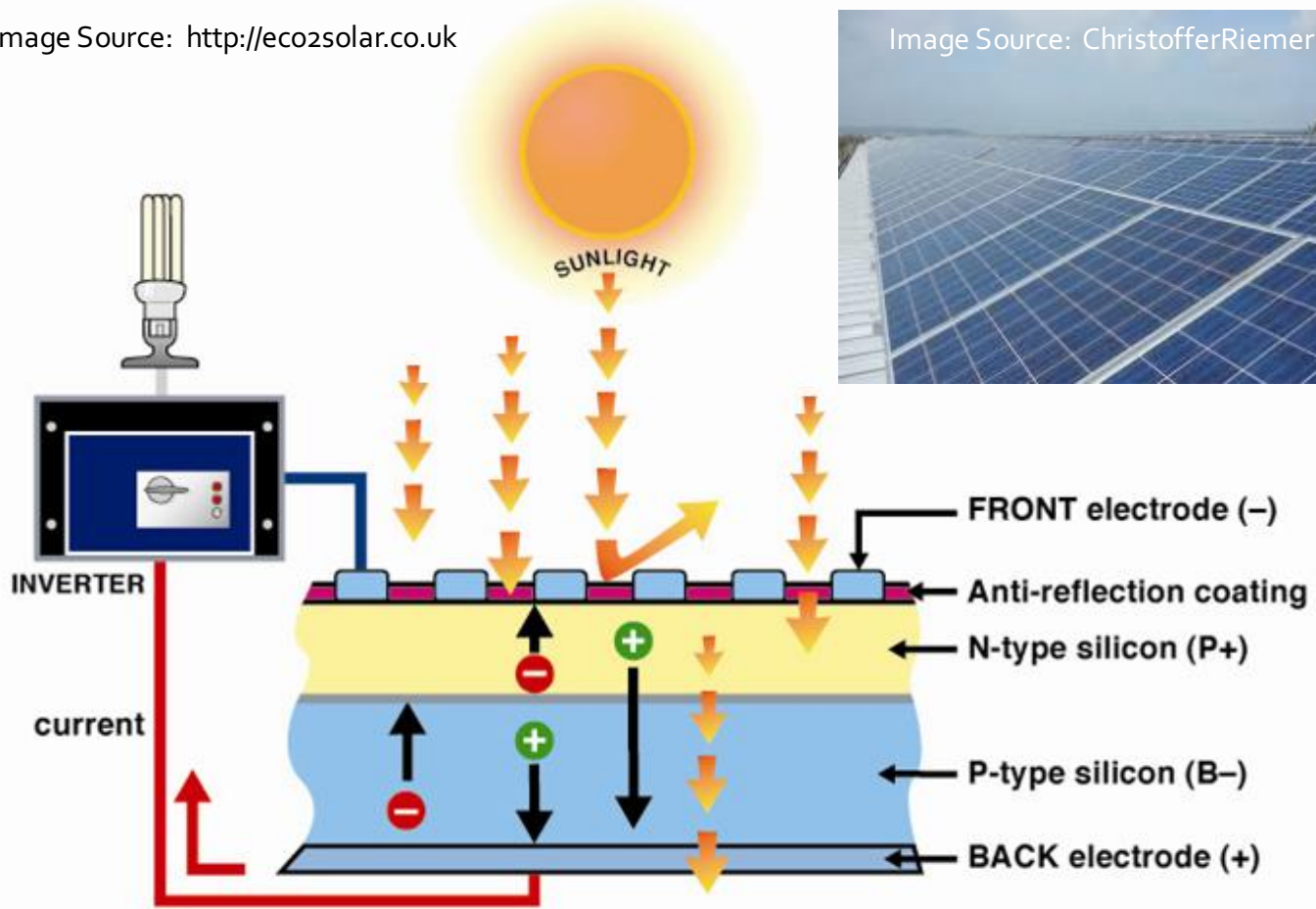
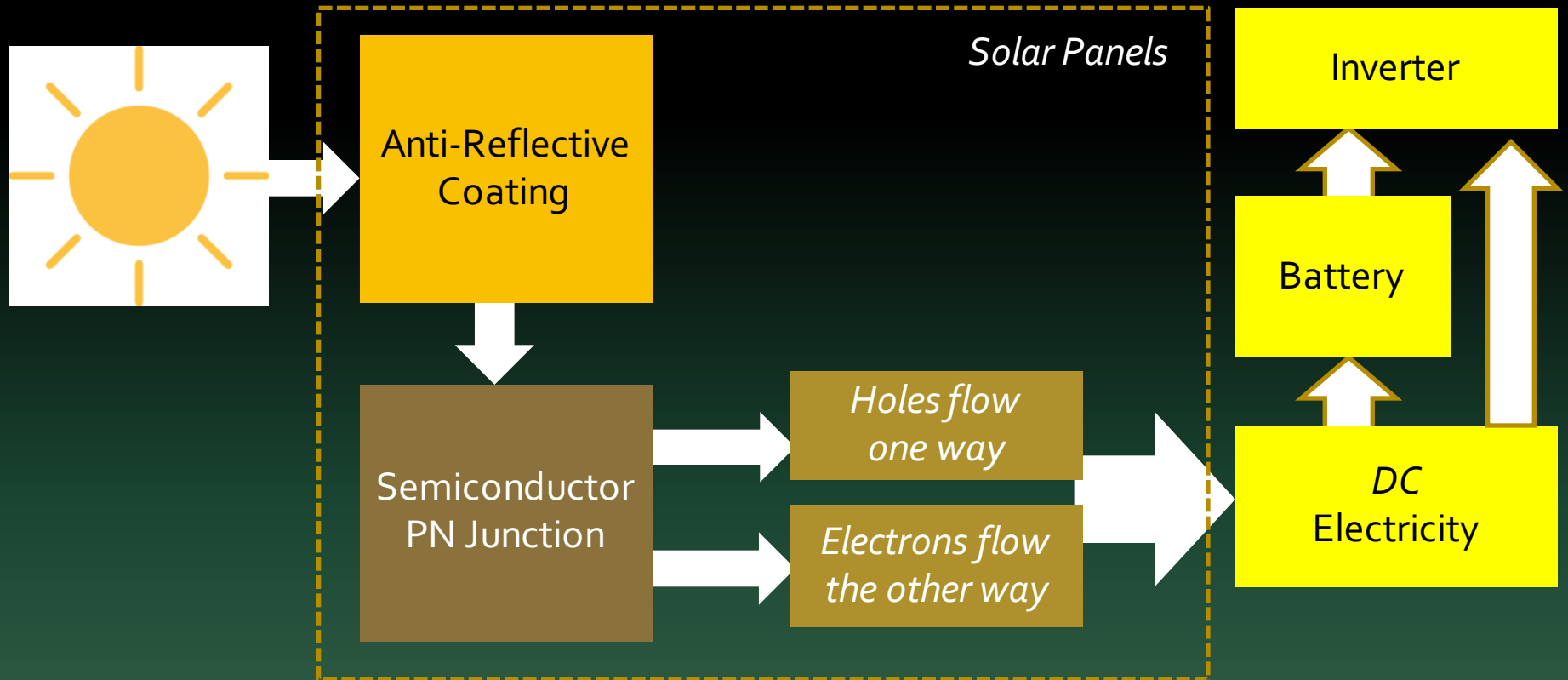


image source: Wikimedia Commons

Producing Electricity from the Sun

How does it work?

Method #1: Photovoltaic (PV)



1. Sunlight passes through an anti-reflective coating to transmit the most light to the PV.
2. The PV is a PN junction which receives light and converts it to free electrons and holes.
3. Free electrons and holes become a constant (DC) current that can either be:
 - Stored in a battery until it is needed as DC (constant) voltage and current.
 - Directly converted by an inverter from DC to AC (time-varying) voltage and current.

Solar Power

How does it work?

Method #2: Solar Thermal

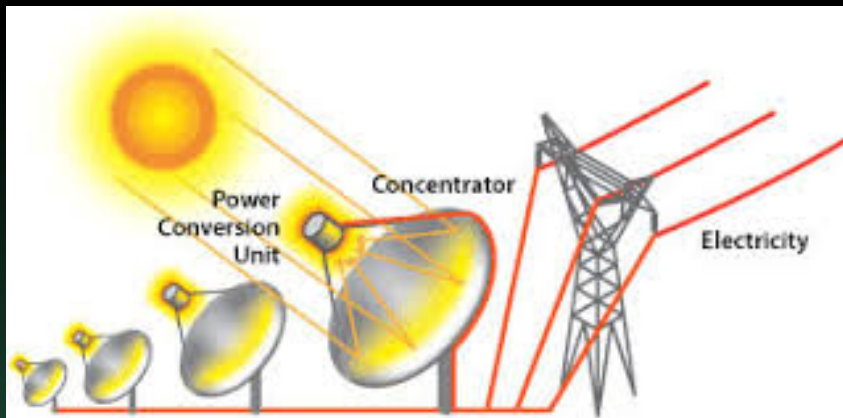


Image Source: Richard Gifford from Sydney, Australia

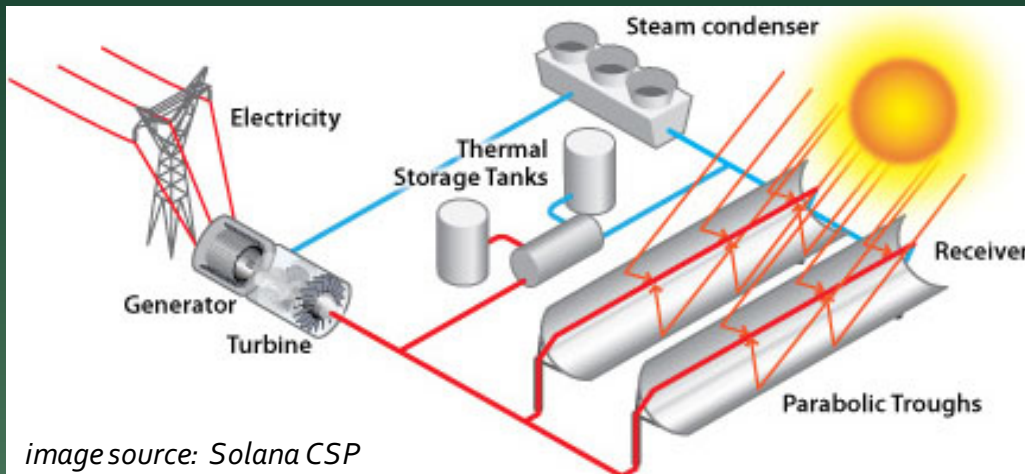


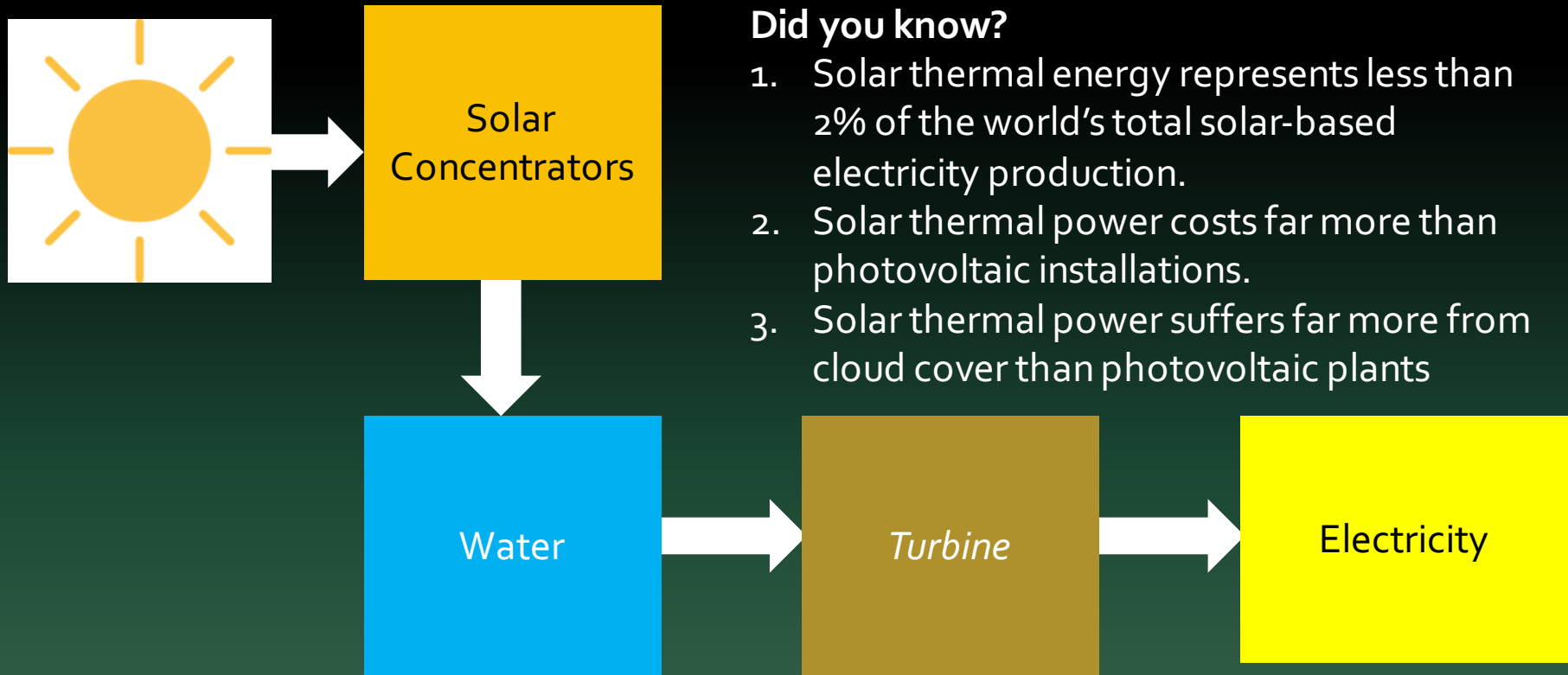
image source: Solana CSP



Producing Electricity from the Sun

How does it work?

Method #2: Solar Thermal



Did you know?

1. Solar thermal energy represents less than 2% of the world's total solar-based electricity production.
2. Solar thermal power costs far more than photovoltaic installations.
3. Solar thermal power suffers far more from cloud cover than photovoltaic plants

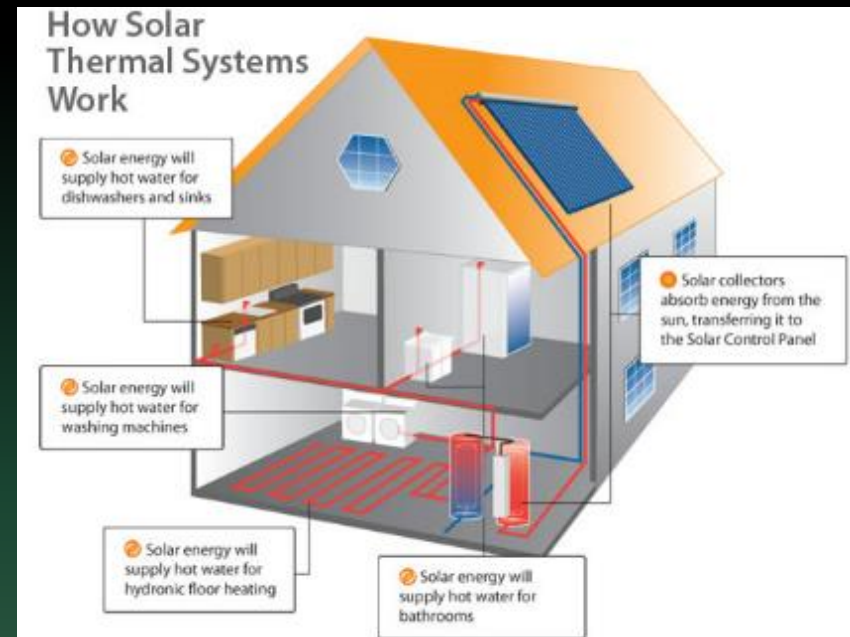
1. Sunlight is concentrated using troughs, dishes, or other technology.
2. The intensified sunlight heats water.
3. Water becomes steam.
4. Steam turns the blades of a turbine and produces electricity.

Using Energy from the Sun

Multiple Approaches



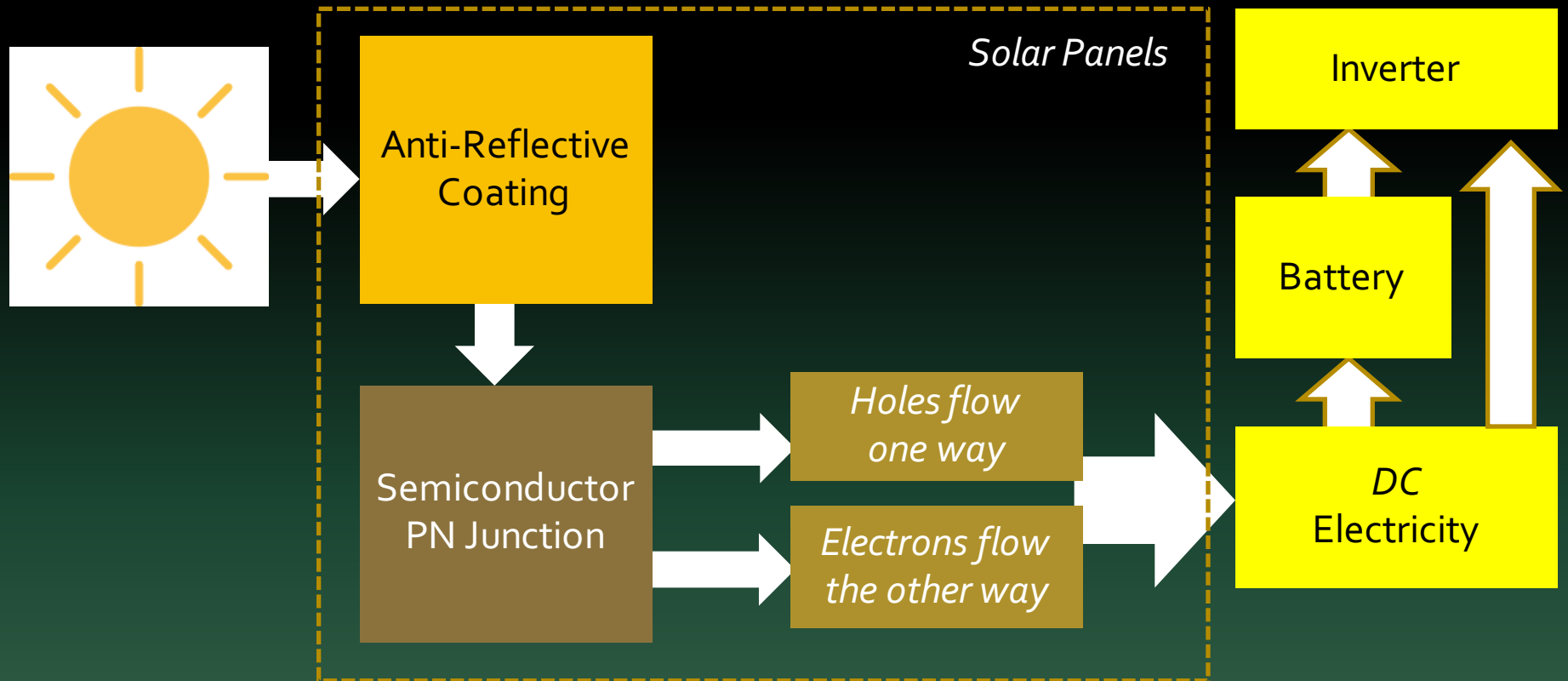
Solar thermal plants and
Photovoltaic (solar panel) plants
Produce Electricity



Solar energy can also be used to heat
water in the home or to heat the home
directly through placement of sunrooms
and other techniques. These approaches
Do Not Produce Electricity

Producing Electricity from the Sun

How does it impact the environment?

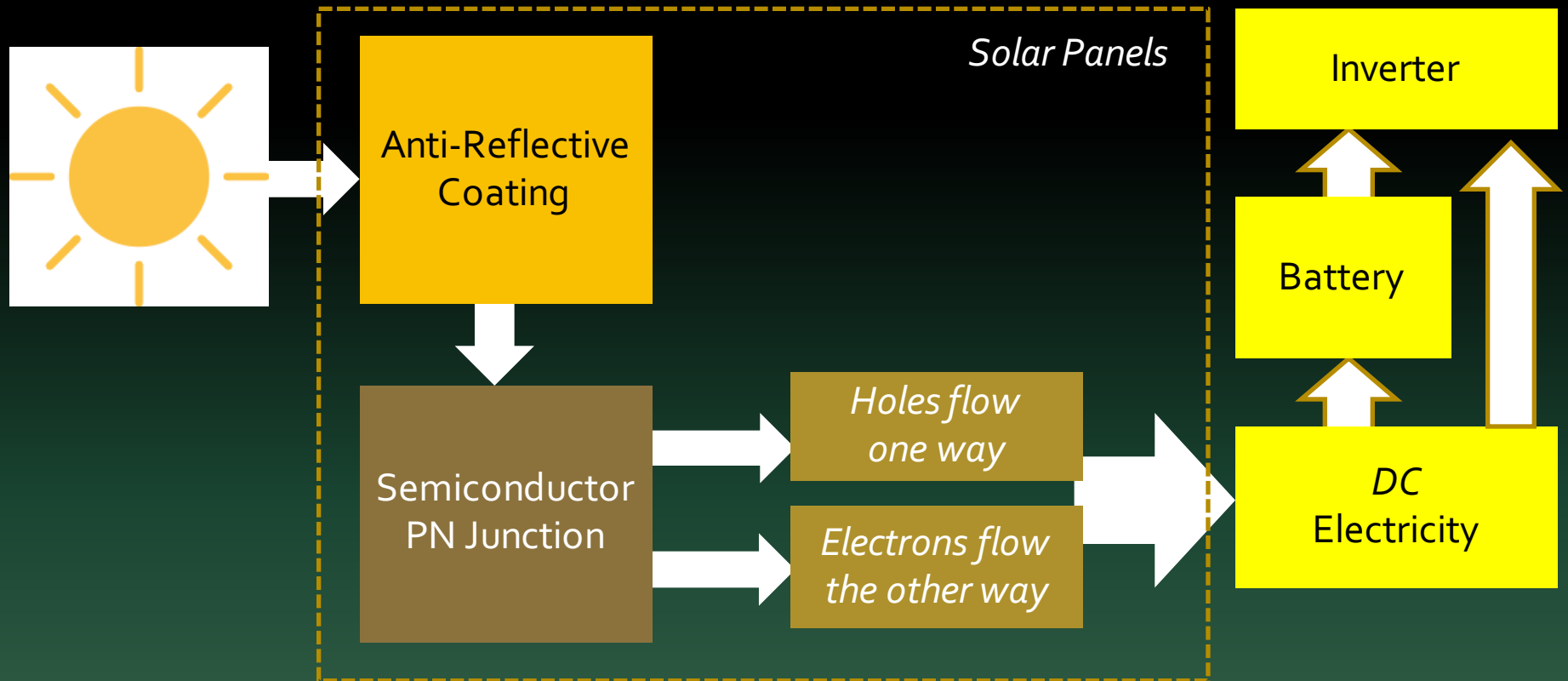


Air Quality and Greenhouse Gas Emissions from Solar Photovoltaic (PV) panels

- Solar PV power has ZERO GHG emissions and ZERO air pollution during use.
- But, PV power does produce GHG emissions during manufacturing, transport, installation, decommissioning, and dismantling – about 0.19 pounds of carbon dioxide equivalent gases per kWh of energy produced compared to 2 pounds per kWh for burning coal.

Producing Electricity from the Sun

How does it impact the environment?

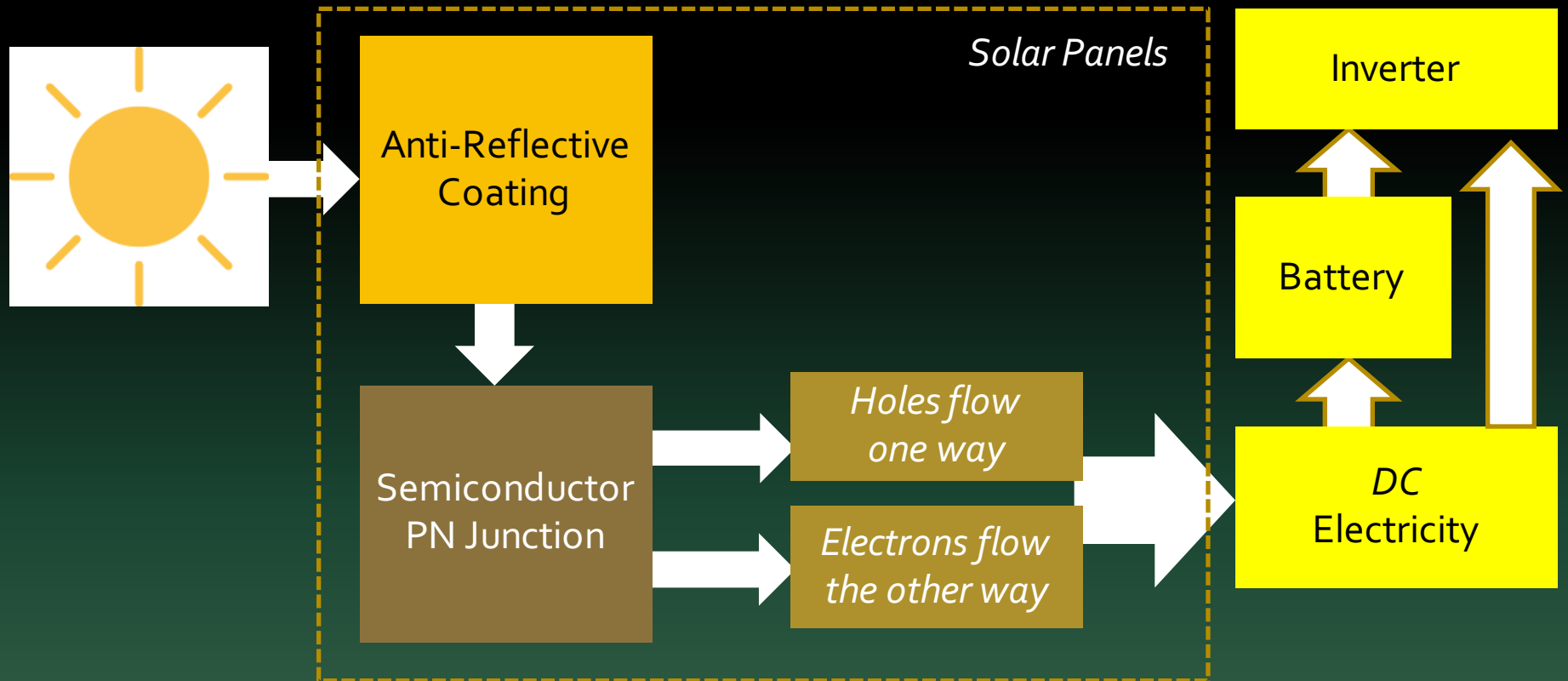


Water Usage

Solar PV power uses no water during regular operation. However, semiconductors used to make PV panels consume large amounts of water during manufacturing. Even when manufacturing is taken into consideration, solar PV plants use about 0.03 gallons/kWh compared to 0.49 gallons/kWh for burning coal for electricity.

Producing Electricity from the Sun

How does it impact the environment?



Other Impacts

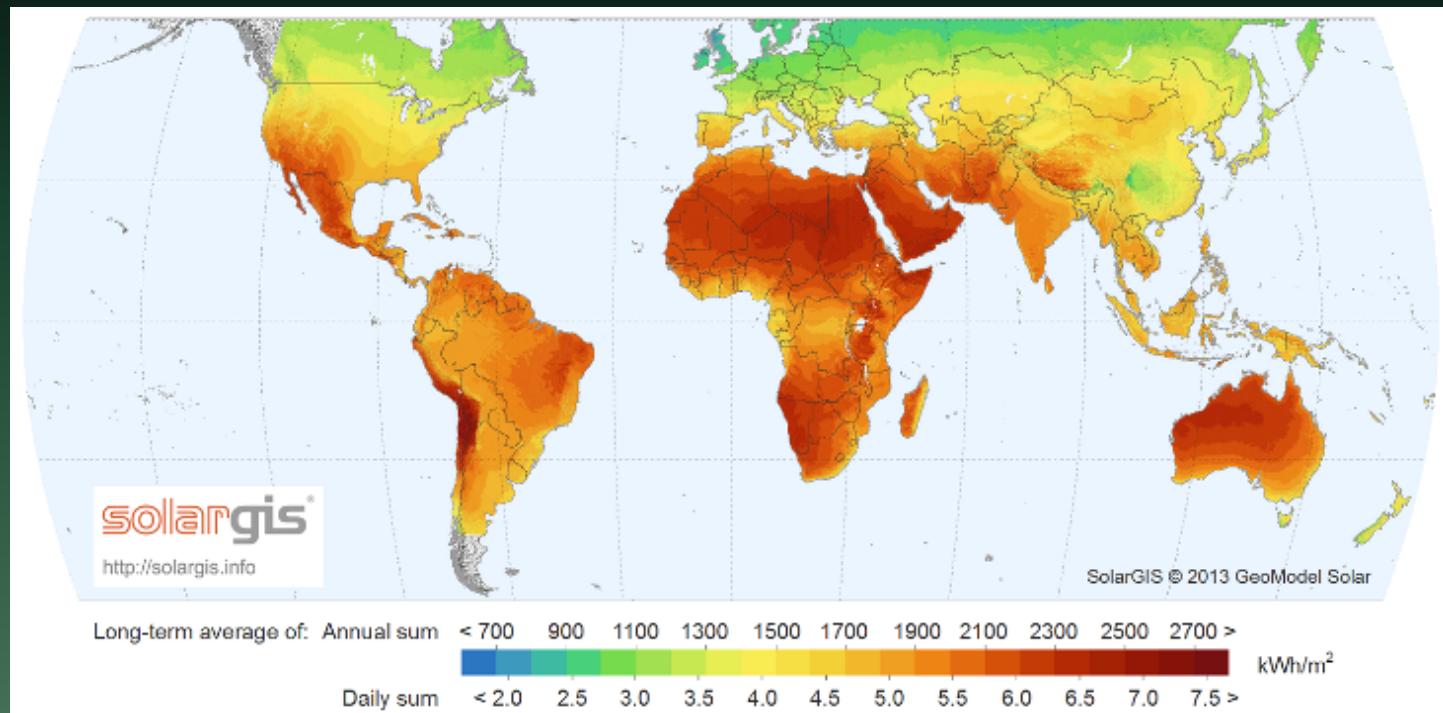
- Land Usage: Solar PV can use between 3.5 and 10 acres per megawatt, land cannot be shared with other uses as is the case with wind power.
- Solar PV cells contain quite a few hazardous and toxic materials including arsenic and cadmium which means they must be disposed of or recycled properly to prevent harm.

Producing Electricity from the Sun

Why does the U.S. use solar power?

Despite the fact that solar power is more expensive than other forms of electricity production, Solar (Photovoltaic) Power takes advantage of the earth's most reliable and abundant source of renewable energy.

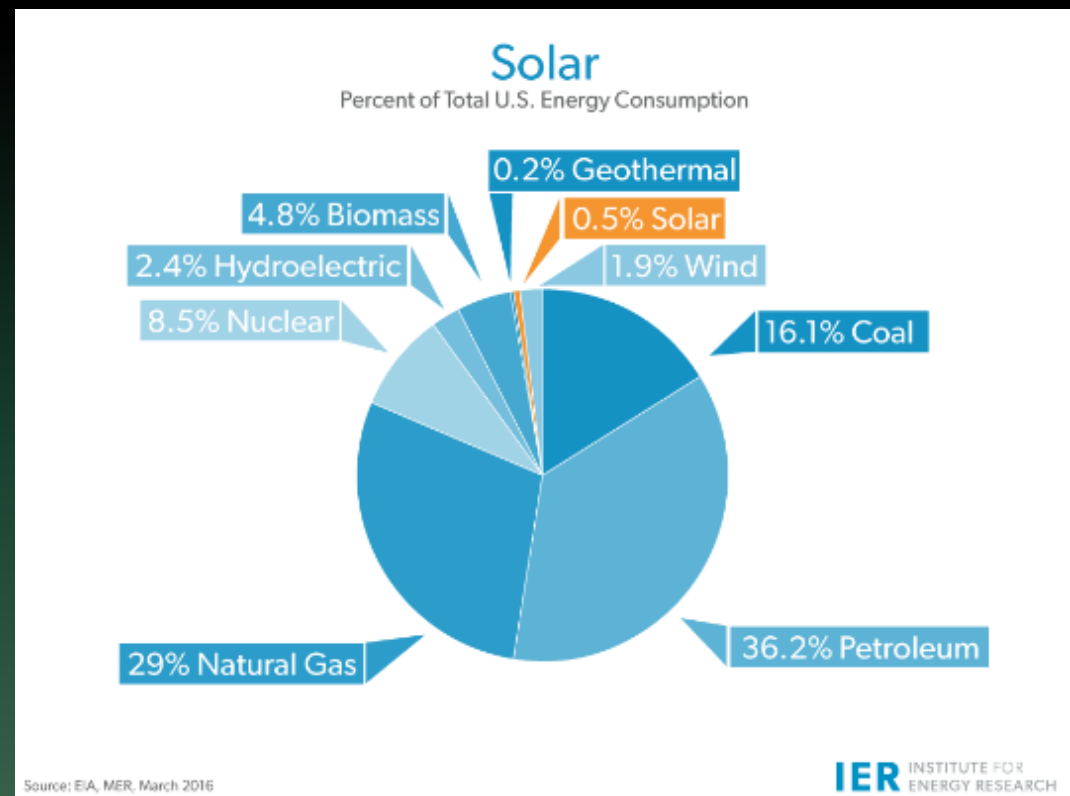
- 12.2 TRILLION watt hours per square mile reach the earth every year, compared to
- global electricity production which is presently around 20,279 TRILLION watt hours per year.



Producing Electricity from the Sun

What's next for the U.S.?

Solar Energy is clean and abundant. Costs continue to decrease and solar power is expected to increase as a percentage of overall electricity production and as a percentage of renewable energy production well into the foreseeable future.





Environmental
Impacts of Technology

Additional Impacts

<http://comingalongside.org/Technology/>

<http://labs.ee.washington.edu/community/EnvironmentallImpacts/>