SOLAR ENERGY

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DESN 3038
RCAW Presentation

Introduction to solar energy

- Solar energy, or energy from the sun, is identified as the cleanest and most abundant renewable energy source available.
- Solar is one of the most talked-about alternative energy sources in the world today.
- Enough energy comes from the sun in one hour to power the global population for a year.
- The United States possesses some of the richest solar resources in the world.

How solar energy works

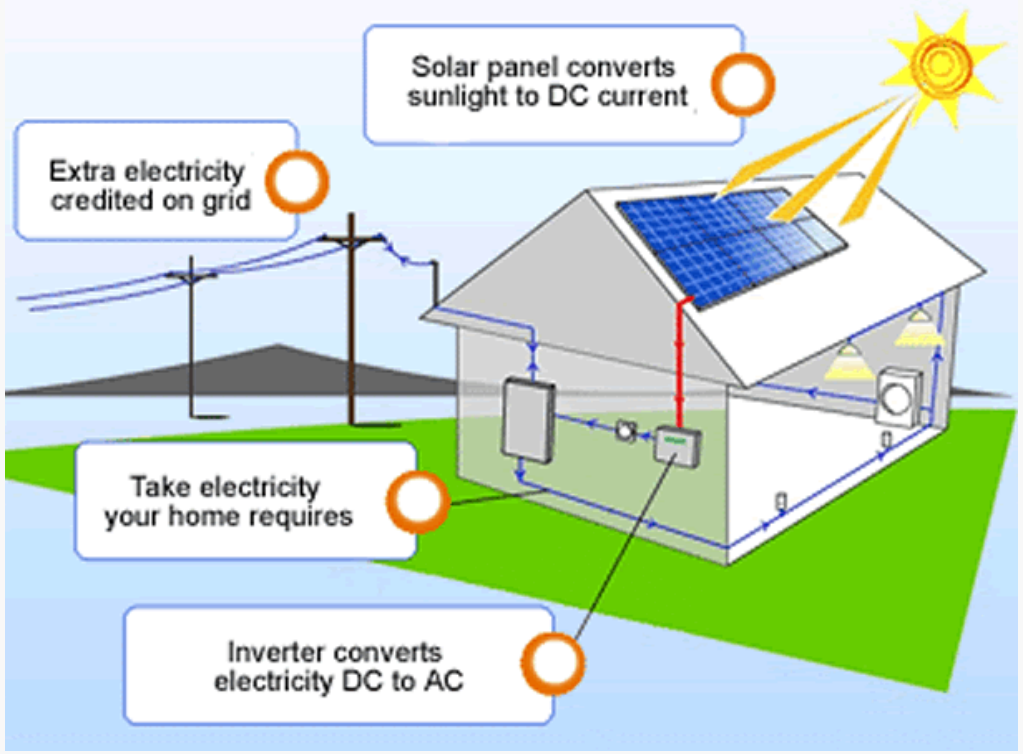


Figure 1 shows how the sun travels through a home.

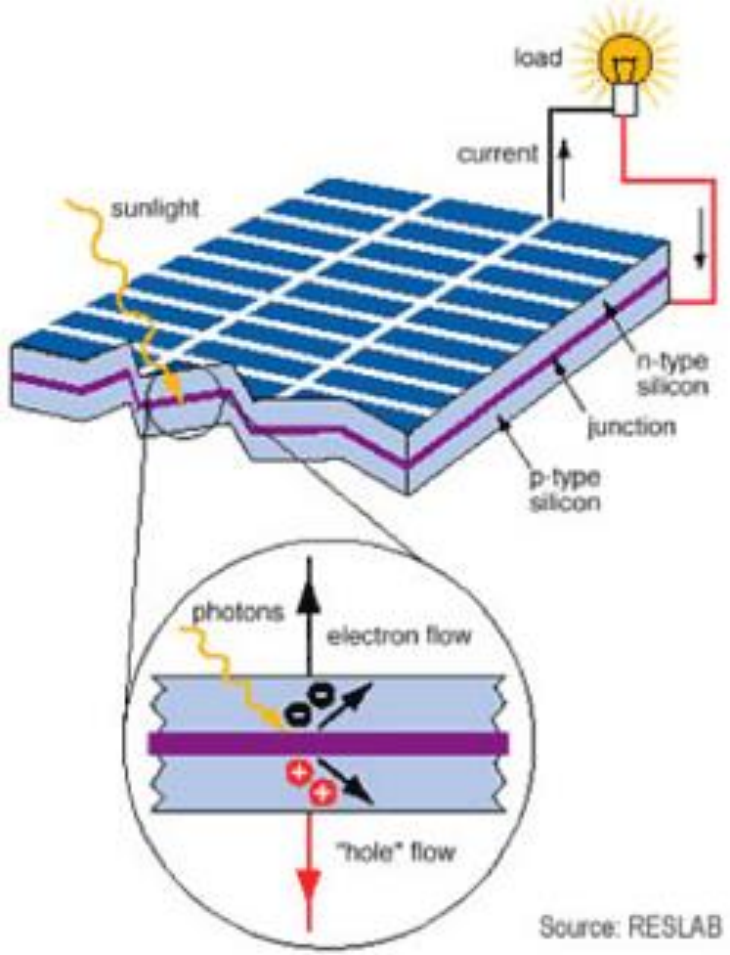
1. The conversion of the sun's heat and light hits the solar panel.
2. Solar panel converts sunlight to DC current
3. Inverter converts electricity DC to AC
4. The home will take all the electricity is needs
5. The extra electricity is credited on grid

Image source: Harrisons Energy Solutions., 2015

Ways to harness Solar Energy

- Photovoltaics (also called solar electric)
- Solar heating & cooling
- Concentrating solar power (typically built at utility-scale)
- Passive solar

Photovoltaics (Solar Panels)



A photovoltaic cell is identical to a solar cell. These cells directly convert light from the sun into electricity. When photovoltaic cells are connected together, we will end up with a solar panel. Photovoltaic cells uses a thin layer of semi-conducting materials called Silicon. When the sun hits the photovoltaic cells in a solar panel, this creates direct current (DC). Then it travels to an inverter, which then the inverter changes it to the electricity used by homes and businesses which is alternating current (AC). Alternating electricity then moves to the circuit panel located in your building, now it will be about to power anything around you.

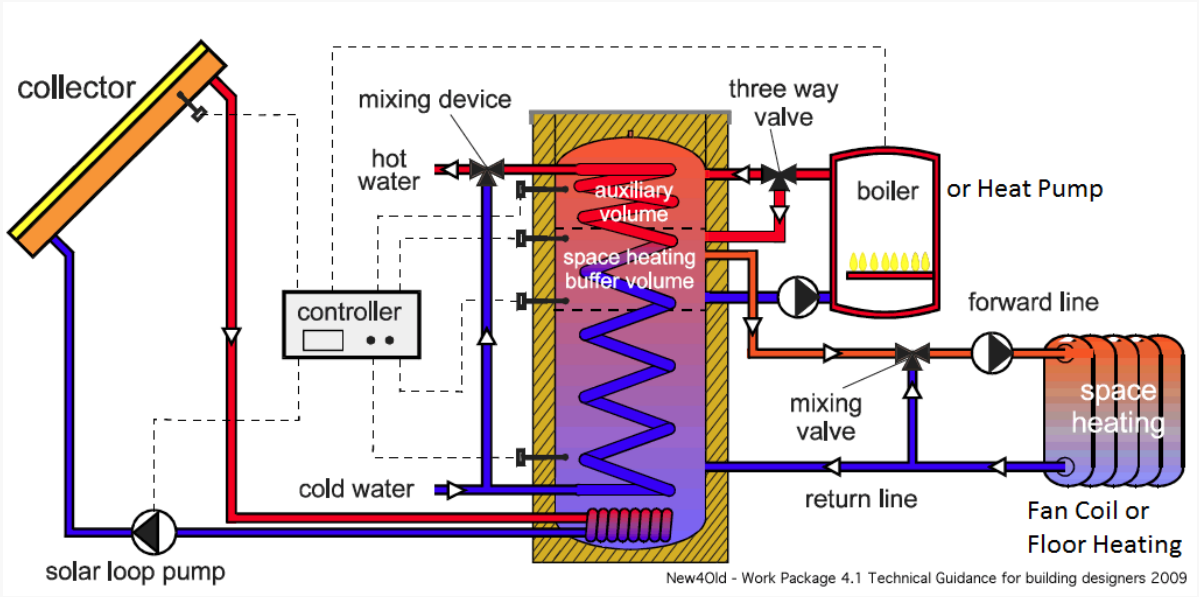
← Figure 2 shows the process of solar energy being converted in a photovoltaic cell

Image source: U.S. Department of Energy Federal Energy Management Program., 2012

Solar heating & cooling

According to Heindl Server GmbH (2010), “the world’s largest solar thermal vacuum tube collector system provides power for the largest adsorption cooling system worldwide.”

Figure 4 →



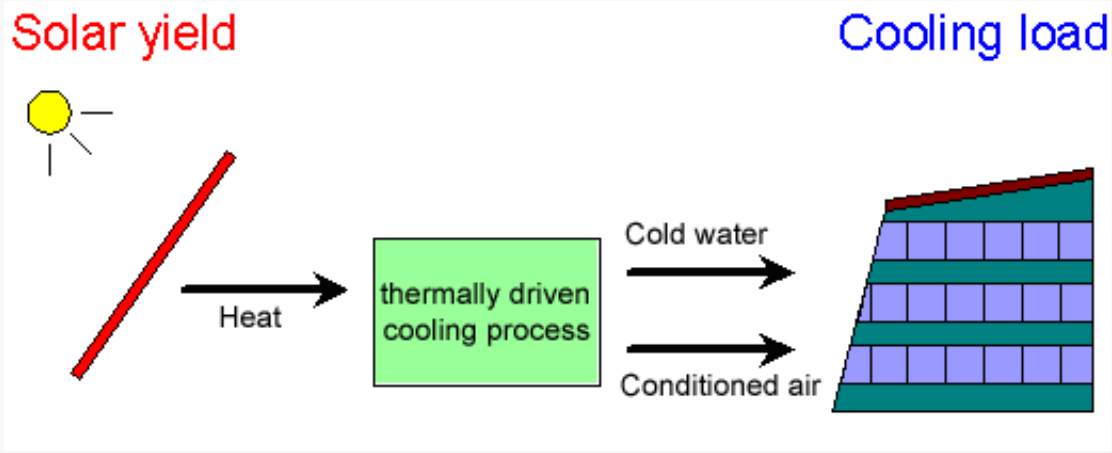


Image above, Source: SolarServer Online Portal to Solar Energy

← Figure 3

Image to the left, Source: Netgreen Developments LDA., 2012

Concentrating Solar Power

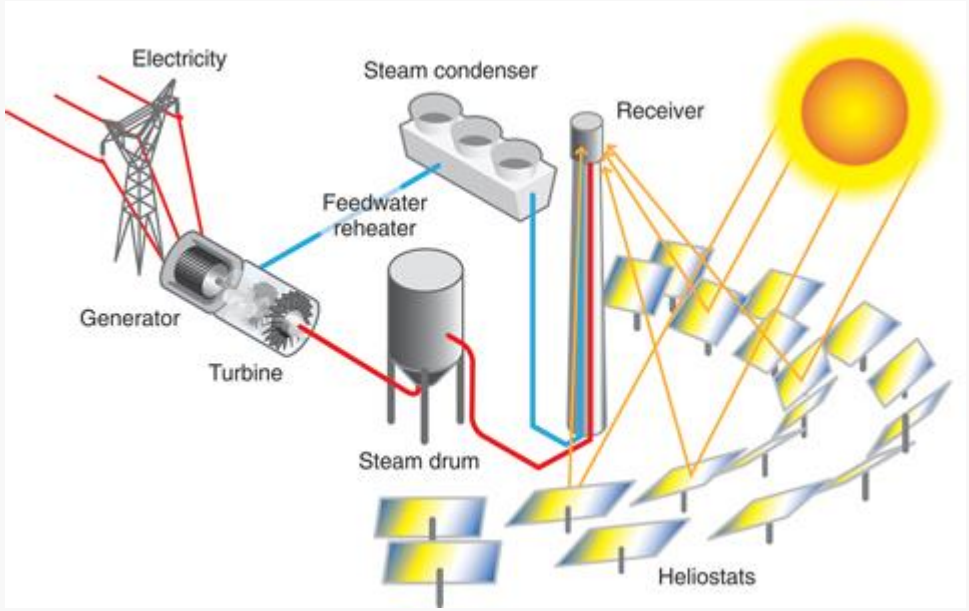


Image Source:
U.S. Department of Energy., 1996

Figure 5 exemplifies several large, flat, sun-tracking mirrors, which are referred to as heliostats, that emphasize sunlight onto a receiver at the top of a tower. A heat-transfer fluid heated in the receiver is utilized to produce steam, which is then used in a conventional turbine generator to generate electricity. (USA.gov., 1996)

Passive Solar

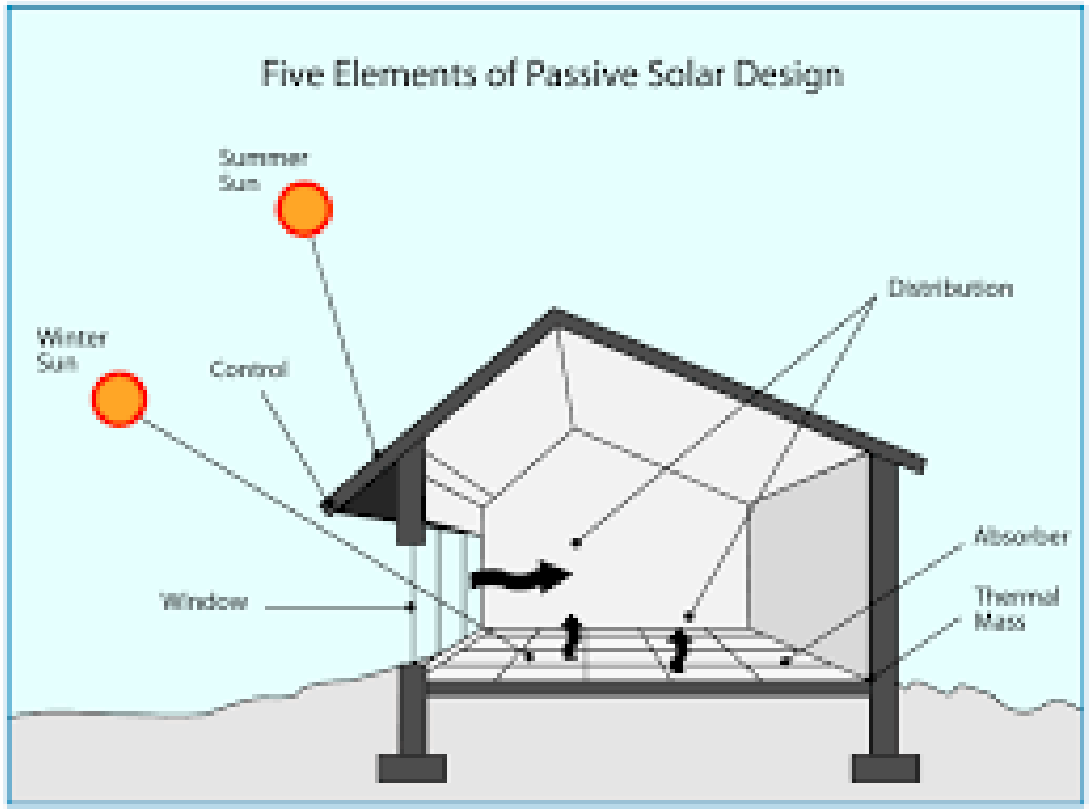


Image Source: Green Energy Times., 2012

Passive Solar is a building design that includes windows, walls and floors. The are designed to collect then store the distribute the solar energy in the form of heat in the winter and it is made to reject solar heat in the summer.

The five elements of Passive Solar are;

1. Aperture
2. Absorber
3. Thermal Mass
4. distribution
5. Control

Figure 6 shows the components of a Passive Solar design house. This diagram also demonstrates the manner that the summer and winter sun shines inside a passive solar house.

Inside a Solar Panel

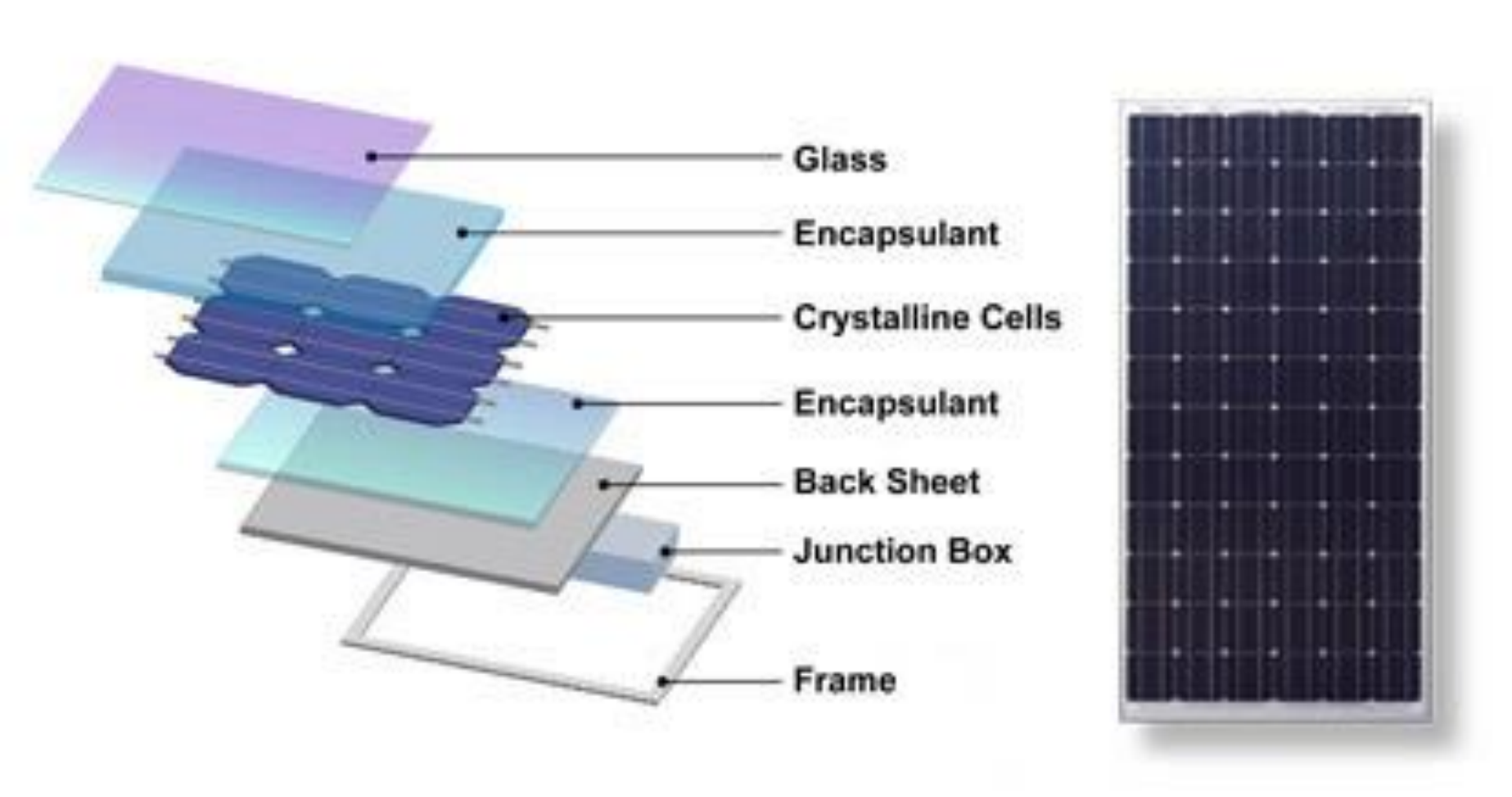
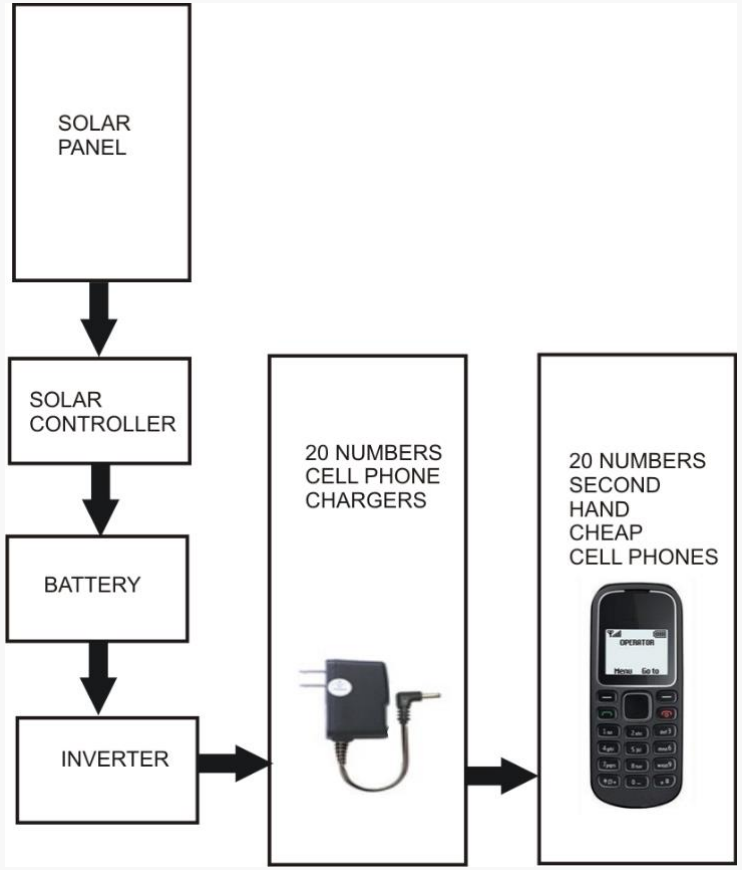


Figure 7 shows the several layers of a Solar Panel.

Image source: Dow Corning Corporation., 2010 - 2016

How a Solar Panel Charging Station works



In this diagram, it shows how the charging station works. The charging station was created by placing a solar panel on the top, which was connected to the solar controller then to the battery and made its way to the 100 watt inverter. Taking in account that 15 cell phones would roughly consume 20 to 30 watts hours of power, an invert of this wattage adequately serve the intended purpose and this set up could charge up to 20 smart phones as well as a laptop.

Image source: Majumdar, S., 2016

East Carolina University Solar Panel Charging station

The image on the left shows my team finishing putting the last touches of our Pirate Nation Charging Station.

For our solar panel charging station it took approximately an hour for a dead cell phone to be fully charged.

Image source: Baity, C., & Hollis, C., 2015

The image on the left is Dr. Chin check out the other solar panels that were made in my class.

The image on the right are charges hanging from the solar panel, to show we used multiple charges. It would have worked for 4 different types of phones.

Image sources: Baity, C., & Hollis, C., 2015

References

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