# HARNESSING THE SUN

## DISCOVERY

The Sun is hot. *Unbelievably hot*. The temperature at its core is a scorching 16 million degrees Kelvin. A furnace of nuclear reactions inside the sun churns out vast quantities of energy. After passing through deep space, a tiny fraction of this energy reaches Earth's surface. Still, 4,000 billion billion joules (4,000,000,000,000,000,000,000 joules) of solar energy pummel the Earth every hour. That's enough to meet the world's energy demands for an entire year!

Solar power is the process of harnessing the Sun's energy and transforming it into a more useful form, such as electricity. It starts with a solar panel – a flat surface made of a special material (a semiconductor such as silicon or germanium) designed to absorb as much sunlight as possible.

The Sun's energy is absorbed by electrons inside the semiconductor. These electrons gain enough energy to free themselves from the chemical bonds holding them in place. They become free to move around the material and conduct electricity. An electric field inside the material pushes the electrons in one direction, creating a flow of electric current. This is a *photovoltaic solar cell*.

## INNOVATION

Today, solar cells have a multitude of uses in homes, industry, and even in space. Solar power provides 0.5% of Earth's total energy consumption.

One of the most promising recent advances is *solar cell paint*. This is literally solar cells in a liquid from that can be "painted" onto any surface. Solar cell paint is made from millions of tiny particles, called *quantum dots,* suspended in a liquid. A quantum dot is a nanoparticle with thousands of electrons trapped in it. Due to the laws of quantum mechanics, the confined electrons exhibit wave behaviour, with specific resonant frequencies.

When we shine light of certain frequencies on a quantum dot, the electrons within it absorb the light and re-emit it at a well-defined resonant frequency. This leads a quantum dot to shine a specific colour.

The precision of quantum dots is extremely useful. Electronics manufacturers worldwide are working on next-generation televisions with quantum dots. Solar cell paint can be put in more places than traditional solar cells, and it has the potential to be mass-produced more cheaply.

## IMAGINATION

Solar power has incredible potential. Imagine fully harnessing the energy that travels from the Sun every day. It has been predicted that, by 2060, solar power may become the dominant source of energy worldwide. How can we make solar cells more efficient? How can we build them on large scales?