

Breakthrough Sustainable Advances In Solar Energy

Are advances in solar energy providing the answers we need as a planet? In view of the [rising cost](#) of non-renewable energy sources like oil, gas, and coal, heating bills have reached their [highest levels](#) in ten years. Economic and political conditions continue to limit energy sources, such as [OPEC+ cutting oil production](#). The war in Ukraine caused the United States and other countries to [ban oil imports from Russia](#). Despite these limiting factors, demand for energy is expected to grow, as it did in the [U.S. in 2022](#), and energy costs for the average household may continue to increase.



A photovoltaic power station in Yinchuan, in China's northwest Ningxia Hui Autonomous Region.

Source: [EPA Images](#)

Equally, a clean energy revolution is underway globally. Solar energy, a renewable energy source, offers [inexhaustible](#) free energy for our planet. Moreover, manufacturing [costs](#) associated with solar technology are in an almost constant decline. Many nations have [set ambitious goals for the deployment of solar power](#).

They indicate that the use of solar energy will continue to increase significantly.

What are sustainable advances in solar energy?

Specifically, new technologies are currently being utilised to generate electricity from solar energy. Simply put, sustainable advances in solar energy refer to recent technological advancements and innovations in the field of solar energy. Globally, there has been [growth in solar energy applications](#), as it can generate electricity, [desalinate water](#) and generate heat, etc. Conversely, as the [price of solar technology continues to fall](#) and the environmental benefits of solar energy become more widely recognised, it is likely that more and more individuals and businesses will turn to solar as a source of electricity.

From 2010 to 2018, the cost of generating electricity by solar PV plants decreased by 77%. However, [solar PV](#) installed capacity progress expanded 100-fold between 2005 and 2018. The installed capacity of solar energy worldwide has [rapidly increased](#) to meet energy demands. The installed capacity of PV technology from 2010 to 2020 increased from 40 334 to 709 674 MW.

Advances: the way Solar energy is used in Specific nations

The [future](#) of solar energy looks bright, with continued growth and innovation expected in the industry. The distribution of solar radiation and its intensity are [two crucial factors](#) that influence the efficiency of solar PV technology. Accordingly, these two parameters vary among different countries. Nations including the Middle East, Australia, North Africa, China, the USA, and Southern Africa, to name a few, have a lot of potential for solar energy technology.

To put it into context, [China's wind power capacity reached 280 GW in 2022](#) and its [solar PV](#) capacity is 300 GW. Its capacity, including onshore and offshore, has quadrupled since 2017. It is now almost comparable to the combined capacity of the other top 7 nations. Numerous causes, including governmental initiatives, technical developments, and rising demand for sustainable energy are to blame for this quick increase.



Distinctive advances in solar energy can create a thrivable future.

Source: [Alamy](#)

Similarly, the yearly increase in solar power in the EU has risen by 47% from 28.1 GW in 2021. In response to a [heightened energy crisis](#) and growing worries about energy security, the EU's total solar power capacity increased by a massive 25% in only one year, from 167.5 GW to 208.9 GW in 2022. This year, 53.6 GW is expected to be added.

Progression: Advances in Solar energy

In addition to that, as of 31 March 2023, there are [over 3.44 million solar PV installations](#) in Australia. Each of these has a combined capacity of around 30.5 gigawatts. Again, [many of the biggest solar farms in the world](#) are located in the United Arab Emirates. This is thanks to the country's plentiful sunlight and vast, vacant tracts of land. Again, the National Renewable Energy Laboratory (NREL) in the United States has [estimated](#) that the solar energy potential within the country is capable enough to provide 400 zettawatt-hours (Zwh) annually.



Solar panels mounted in a solar farm provide sustainable advances in solar energy.

Source: [Popular Mechanics](#)

Why Is it essential that we focus on sustainable advances in solar energy?

Additionally, modern economies are [driven](#) by sustainable technologies. [Solar energy](#) is a clean and [sustainable](#) power source that could provide energy security and energy independence to all. Such a propensity is [hugely](#) important, not only for individuals, but also for the socio-economic prosperity of companies, societies,

states, and nations.

Some Recent developments and Breakthroughs in Solar

Solar energy technology has progressed in leaps and bounds in just a few years. Recent sustainable advances include:

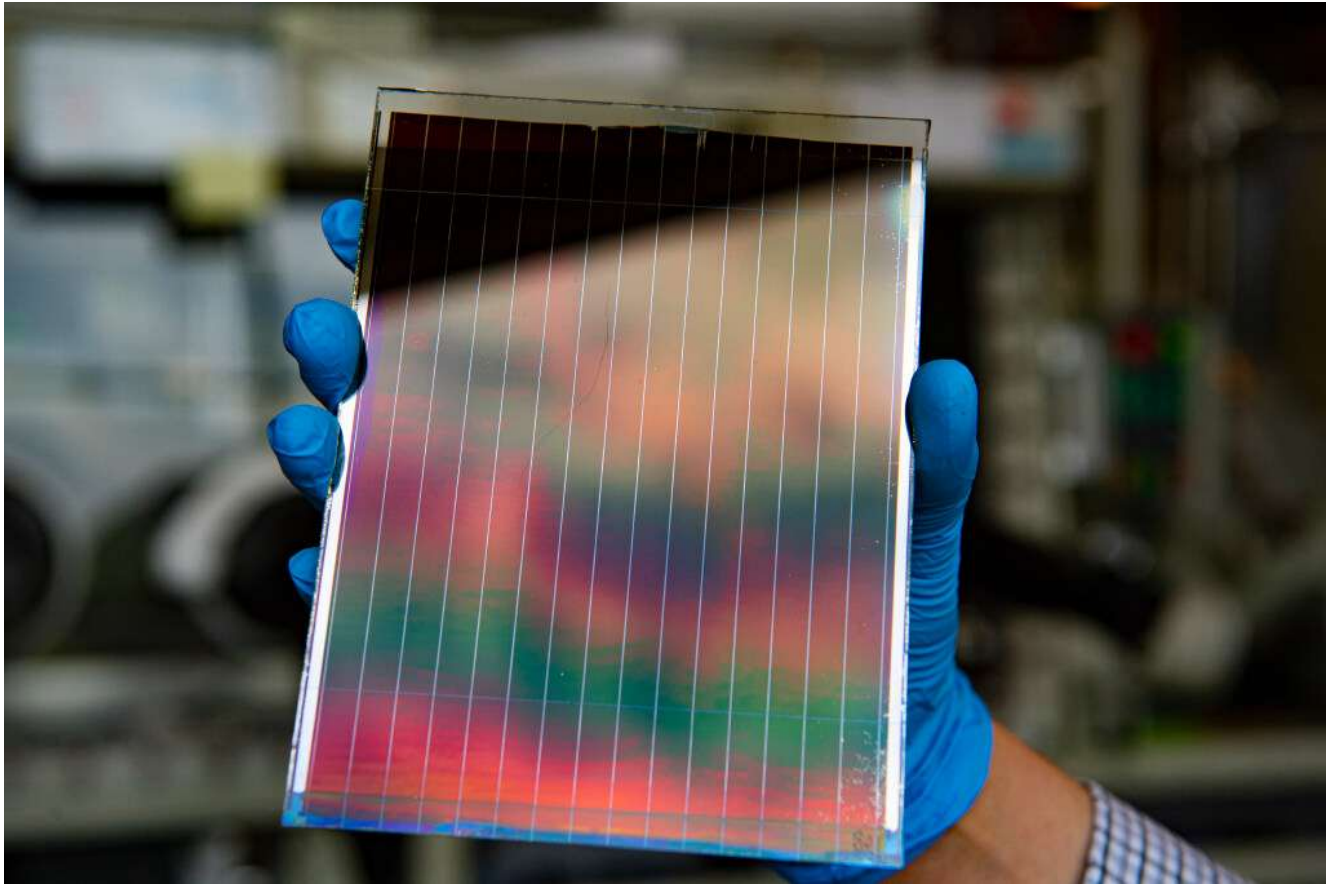
Solar Cell Efficiency

Conversely, solar panel efficiency is a measure of the amount of sunlight (irradiation) that falls on the surface of a [solar panel](#), converting it into electricity. Due to the many advances in solar PV technology over recent years, the [average panel conversion efficiency has increased](#) from 15% to much more than 22%. This large jump in [efficiency](#) resulted in the power rating of a standard-size panel increasing from 250W to over 420W.

Perovskite Solar Cells

Significantly, solar cells made from perovskite crystals can be as much as [20%](#) more efficient than solar cells made from silicon. The efficiency of perovskite solar cells to convert sunlight to electricity has [increased](#) dramatically over the years. Accordingly, a [team](#) at the US National Renewable Energy Laboratory (NREL) developed a new approach to manufacturing perovskite solar cells. It addressed previous problems and yielded devices with high efficiency and excellent stability.

Similarly, engineers from Princeton University recently published an article in [Science](#) that introduced the first perovskite solar cell with a commercially viable lifetime. These are all significant steps toward perovskite photovoltaics becoming a [standard](#) component in solar installations worldwide.



A perovskite solar cell.

Source: [NREL](#)

Solar Power At Night

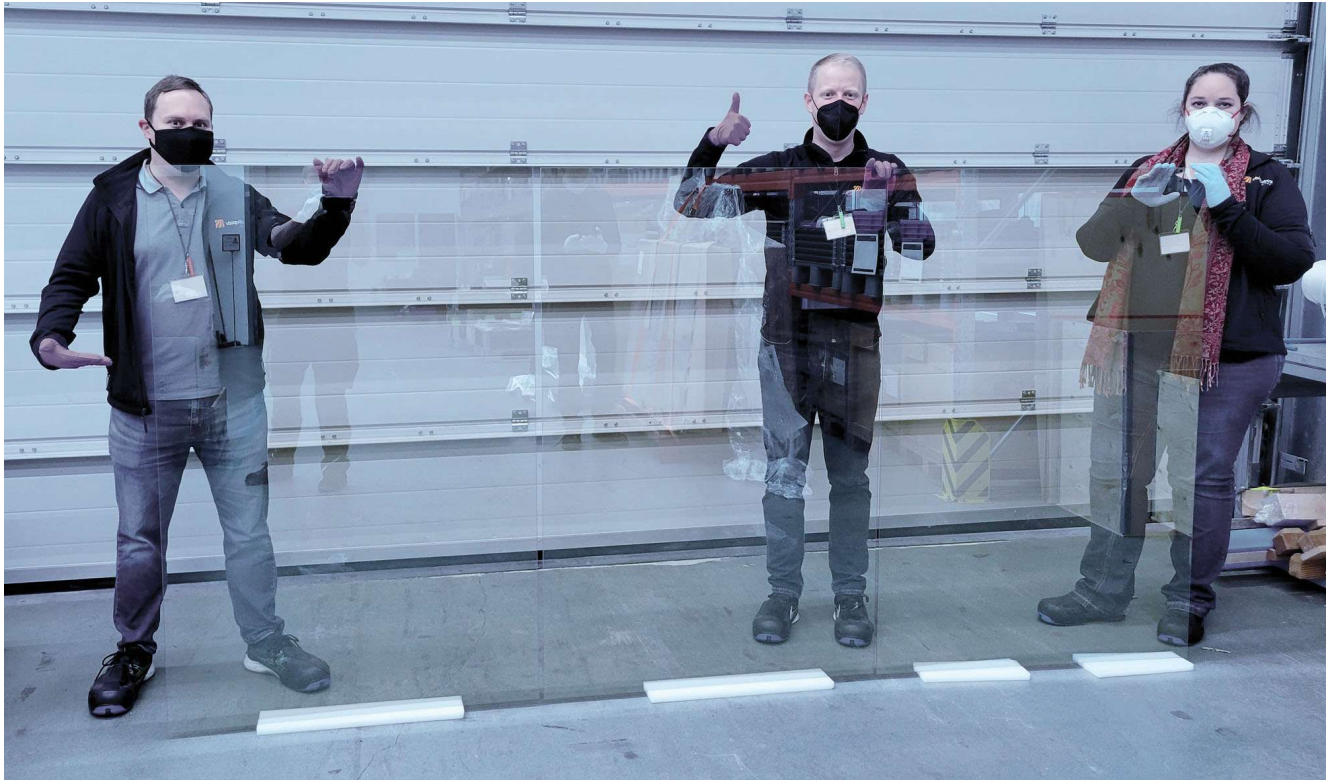
During the day, solar radiation significantly warms the planet. In general, however, energy is lost to the atmosphere and the cold surrounding space. Significantly, in new research published in the journal [ACS Photonics](#), a team of photovoltaics engineers at UNSW Sydney, Australia, demonstrated a successful test run of their new device, capable of converting this thermal energy into electricity.

Solar Windows

Presently, in a [solar window](#), a transparent coating or material [gathers](#) some of the energy from the light passing through the window, and building [materials](#), and stores it as electricity. Unlike solar panels, it allows some of the light spectrum — visible light — to pass through, while collecting energy from the infrared and ultraviolet light we cannot see.

[Ubiquitous Energy](#), one of the companies developing solar windows, uses a

special glass coating applied during the normal manufacturing process of windows to capture ultraviolet and infrared light energy.



Ubiquitous Energy, one of many Silicon Valley start-ups in the solar technology space, has pioneered transparent solar panels that can transform any window or building facade into a source of clean power.

Source: [UBIQUITOUS ENERGY](#)

Printable Solar Cells

These [paper-thin solar cells](#) may now be created by inkjet printing on paper. This will enable solar cells to be substantially cheaper and installed in practically any place. Conversely, this includes walls, windows, roller blinds, shade umbrellas, and even tents. Recently, scientists from [Swansea University](#) in Wales have developed the world's first '[completely printable](#)' perovskite solar cells using an innovative process.

Solar-Powered Cars

[Solar-powered cars](#) are another technological advancement in solar energy. A solar cell at UC Berkeley [converts](#) solar energy directly into electricity, powering a car's motor. Other solar-powered cars include the [Sunswift solar race car](#) and the [solar car of Abu Dhabi](#). Solar cars can be [ideal](#) for promoting green

transportation, as there aren't any harmful emissions.



Governing bodies around the world are supporting the cause and introducing environment-friendly projects, like [Abu Dhabi's largest solar car park](#).

Source: [Dubizzle](#).

Solar-powered IoT systems

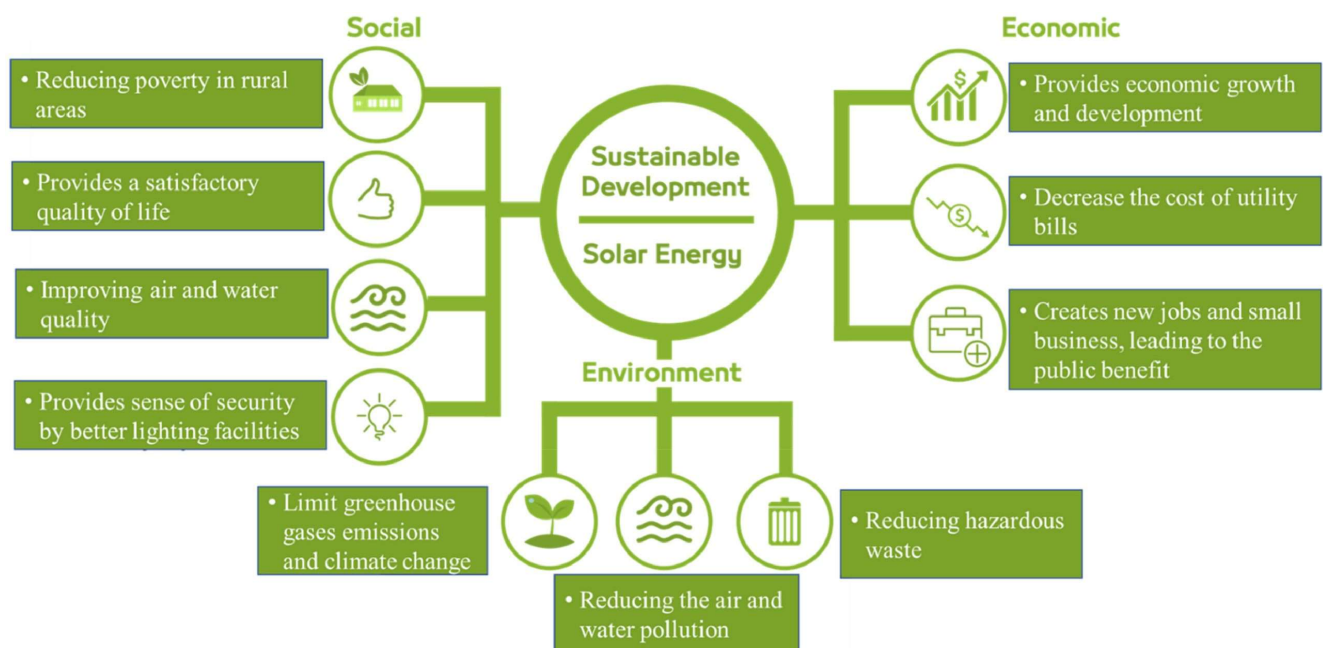
In an era where environmental consciousness and energy efficiency are paramount, the [integration of solar-powered Internet of Things](#) (IoT) devices for energy monitoring has emerged as a groundbreaking solution. Subsequently, these innovative devices provide a chance to monitor and optimise energy use in real-time, due to the accelerating improvements in IoT [technology](#) and the rising need for sustainable practices.

According to a recent report by the [IEA](#), renewables are set to account for over 90% of global electricity expansion over the next five years, overtaking coal to become the largest source of global electricity by early 2025.

sustainable Development Goals (SDGs) and how they are linked to sustainable advances in solar energy

Specifically, advances in solar energy are highly relevant to achieving the [Sustainable Development Goals](#). Solar energy offers environmental, social, and economic benefits that can accelerate our progress toward the [SDGs](#). This type of renewable energy [contributes](#) to the reduction of [poverty](#) and access to affordable and reliable electricity.

Solar energy provides education, [health](#), [clean water](#), and [sanitation](#) while minimising the carbon footprint and greenhouse gas emissions that [protect](#) society from infections and diseases. Subsequently, the [solar industry creates jobs](#), reduces [hunger](#), and increases access to food and shelter. Increasing employment opportunities due to advances in solar energy [creates](#) a more equitable human civilisation, which reduces the corruption rate and strengthens the community.



The use of solar energy will have a number of beneficial social, environmental, and economic effects.

Source: [International Journal of Thermofluids](#)

A Thrivable Framework

[THRIVE Framework](#) examines issues and evaluates potential solutions in relation to the overall goal of [thrivability](#). Significantly, it is about making predictive analyses using modern technology that supports environmental and social [sustainability](#) transformations, for which it utilises the [ciambella chart](#).

Given the advancements in solar technology, it appears that solar energy will become a vital part of our daily lives in the future. Interestingly, solar energy links with other technologies to mitigate sectors with complex [decarbonisation](#) challenges, such as transport, building, [agriculture](#), and manufacturing, among others. This continued deployment of solar energy in various industries will support the global energy transition.

For more information about [solar PV](#), how transparent [solar windows turn to solar panels](#), and several additional resources on [clean energy](#) please visit our [website](#). Follow our informative, diverse [blog](#) and [podcast series](#) and learn about our regular live [webinars](#) featuring expert guests in the sustainability field, including many rich discussions on renewable advances. [Sign up for our newsletter](#) for regular updates.