

# Solar Power: Overview

## Introduction

Solar power is the process of using photovoltaic (PV) cells (often referred to as solar panels) to capture radiation produced by the sun and convert it into more useful forms of energy such as heat and electricity. Solar power is a virtually unlimited renewable resource that provides a ‘cleaner’ source of energy than fossil fuels, which release carbon dioxide and other greenhouse gases into the earth’s atmosphere when they are burned to create energy.

As experts around the world express growing concern about the role of fossil fuel emissions in climate change, the Government has enacted several schemes to encourage Australians to adopt solar power. These schemes have been quite successful: in 2022, more than three million Australian homes had installed solar panels, and more than ten million more panels were in operation as part of large-scale solar farms. Indeed, Australia is one of the top users and producers of solar energy in the world.

However, debate exists as to how much the Government should continue encouraging further solar power development. Those in favour argue that solar power is an environmentally friendly energy source crucial to Australia’s net-zero emissions goals, while opponents argue that the existing power infrastructure already struggles to keep up with the amount of solar energy being generated, and the Government should diversify their investments into other renewable energy technologies.

## Understanding the Discussion

**Curtailement:** A process by which homeowners with solar panels are prevented from transferring unused energy into the power grid, to avoid overloading the grid or dropping the price of energy too low.

**Feed-in tariff:** A fee paid to homeowners with solar panels for each unit of energy they transfer, or ‘feed in’, to the energy grid for use by other households.

**Net-zero:** A term that describes Australia’s goal of reducing the amount of carbon dioxide and other greenhouse gases that are released into the air as a result of manufacturing and power generation.

**Photovoltaic cells:** The technical term for solar panels, sometimes referred to as “PV.” Photovoltaic cells convert solar radiation into forms of useable energy such as heat and electricity.



*Solar panels seen on the roof of The Australian National Maritime Museum on August 2019 in Sydney, Australia. Photo by Mark Metcalfe, Getty Images.*

## History

The ability to harness the sun to create electrical power was first experimented with in the late nineteenth century. Technology quickly advanced, and by the 1950s, silicon-based solar cells had been developed and were beginning to be used in solar panels similar to the ones used in the twenty-first century. In the early 2000s, the Australian Government began encouraging the development and deployment of a variety of renewable energy sources, including solar, hydro, and wind power. Solar power operates by using PV cells arranged as panels to capture radiation from the sun and transform it into DC current. Then an inverter is used to transform the DC current into AC current so it can be used to power homes and offices. Solar power offers a convenience over other forms of renewable energy because the panels can be part of large installations designed to feed the commercial power grid or much smaller installations on residential rooftops to provide power to individual homes and neighbourhoods.

To encourage commercial energy providers to develop and deploy renewable energy sources, the Australian Government established the Renewable Energy Target (RET) scheme in 2001. This scheme required certain businesses to obtain a specified percentage of their power from renewable sources and provide Renewable Energy Certificates (RECs) to the Government each year to document the number of megawatt-hours drawn from renewable sources. These certificates could be banked or traded,

so companies that used more renewable power than required could sell their excess certificates to companies who failed to meet the minimum requirements.

RET also supported state-level Feed-in Tariff (FiT) schemes designed to entice individual homeowners to install panels on their rooftops. Because solar power is intermittent and weather-dependent, households can generate more energy than they can use in that moment. To avoid wasting this excess energy, those systems can transfer or “feed in” power back to the main energy grid. This energy is then sold by the power company to other households on the grid that do not have their own panels. To provide an additional financial incentive for homeowners to install solar energy systems on their roofs, FiT schemes pay a tariff to those households for the excess energy they feed into the power grid. Alternatively, some energy companies will offer those households a discount on energy they purchase from the power company during the times when their panels do not produce enough energy to meet their full household needs, such as at night or on cloudy days.

These schemes significantly increased interest and investment in renewable energy infrastructure. However, both have been subject to criticism. For example, to recover costs associated with FiT schemes, many electricity providers increased the cost of electricity for others on the grid. This meant that people who did not have solar panels effectively subsidized the price of electricity for those who did, which some researchers contend passed the cost on to people who were least able to afford it. And in some cases, local governments reduced or ended FiT schemes with little warning, due to unexpectedly high interest in solar panels. This was a significant financial blow for consumers who had factored the FiT support into their financial decision to install panels in the first place.

Despite the challenges, Australia continued to adopt solar energy at a rapid pace. By 2012, about 10 percent of Australia’s energy came from renewable resources, including solar, wind, and hydropower. Expansion of solar power was further encouraged when the Government introduced a Carbon Tax as part of the Clean Energy Act of 2011. Companies whose power plants generated carbon emissions from burning fossil fuels had to pay additional taxes both as a disincentive to continue burning fossil fuels and to offset the cost of managing these emissions. This often led to higher residential electricity prices as power companies passed on the cost of these taxes to their rate payers. The Carbon Tax and the Clean Energy Act were repealed in 2014, but in many communities, electricity prices did not revert to their pre-tax levels. This spurred even more interest in residential solar energy, as it provided a way for households to reduce their reliance on energy purchased from power companies.

## **Solar Power Today**

Despite the popularity of solar power, debate continues over whether the Government should continue to promote and subsidize its widespread adoption. Proponents argue that solar power is an environmentally friendly and nearly

unlimited source of energy that provides financial benefits to individuals and reduces Australia’s dependence on imported fuel sources. Opponents argue that solar equipment causes its own environmental damage because of the materials used, requires significant and expensive upgrades to existing power infrastructure to support its continued growth, and occupies land needed for food production.

In 2018, Australia had one of the highest rates of residential solar panel installation in the world: about one in five free-standing or semi-detached homes had rooftop panels, with uptake as high as one-in-three homes in Queensland and South Australia. But as more rooftop panels were installed throughout the country, the supply of available electricity increased and demand for electricity supplied by energy providers decreased. This can lead to curtailment, where individual solar panels are shut down either by the energy providers or by the locally installed inverters. Sometimes curtailment is necessary to avoid overloading the power grid if too much voltage is being fed into the system, for example on a mild, sunny day when solar panels are generating a lot of electricity but not much is being used. In other cases, curtailment is initiated by the power company, to prevent a glut of energy from being fed into the grid and driving the per-kilowatt cost of electricity too low.

Research conducted in 2021 by Dr. Baran Yildiz and his team at the University of New South Wales (UNSW) found that some households could have their solar capacity curtailed by up to 20 per cent. This has significant financial implications for affected households: with their panels unknowingly switched off for significant portions of the day, not only are they not receiving a feed-in tariff for supplying power to the grid, but they are also paying to draw electricity from the grid to power their home. Dr. Yildiz and his team noted that households in communities with high solar uptake and those in rural communities with less robust power grids are the most likely to experience significant curtailment, as these are places where the power capacity of the grid is most likely to be saturated.

One contributor to curtailment challenges is that energy is not easily storable. While large batteries can be used in some situations, electrical system operators still must work actively to balance supply and demand across the energy grid in real time. Since widespread adoption of solar power is still relatively new, and solar power itself can be intermittent and highly subject to weather fluctuations, there is not yet much data to assist with reliable forecasts of supply and demand. This uncertainty can lead to overinvestment in capacity which can raise energy prices, or to insufficient capacity which can lead to blackouts.

To address concerns about the capacity of the power grid, in 2021 the federal Australian Energy Market Commission (AEMC) proposed a fee on consumers who feed power back into the grid through residential solar panels. AEMC chief executive Benn Barr explained that the fee was necessary to fund updates to the residential power grid, so it could handle the growing two-way, intermittent flow of energy from residential solar panels. However, solar energy lobbying groups such as Solar Citizens pushed back, stating that solar customers already paid a daily fee

to connect to the grid, regardless of whether they were adding or removing power, and an additional fee for providing power back to the grid would remove the financial incentive to install residential solar panels. They also noted that residential solar customers placed less strain on the power grid than commercial energy providers because their energy most often stayed within their neighbourhood.

Despite the debate, individuals and the Government both showed continued support for solar energy projects. In 2021, even with lockdown and supply chain issues caused by the coronavirus disease 2019 (COVID-19) pandemic, Australians installed a record number of residential solar panels. The Clean Energy Regulator (CER) reported that more than 360,000 customers installed rooftop solar panels in 2021, adding more than 3,000 megawatts of capacity to the system. And in 2022, the Government announced its \$37 million investment in the 200-megawatt Blue Grass Solar Farm in Columboola, Queensland, to provide solar power on a larger scale to more communities.

## About the Author

Tracey DiLascio is a former small business and intellectual property attorney near Boston, Massachusetts. Prior to establishing her practice, Ms. DiLascio taught writing and social science courses in Massachusetts and New Jersey colleges and served as a judicial clerk in the New Jersey Superior Court. Ms. DiLascio is a graduate of Boston University School of Law.

These essays and any opinions, information, or representations contained therein are the creation of the particular author and do not necessarily reflect the opinion of EBSCO Information Services.

## Bibliography

Chenu, Mal, and Marjan Nazifi. "How Australia's Transition to Renewable Energy is Actually Progressing." *The Lighthouse*, Macquarie University, 10 Sept. 2020, [lighthouse.mq.edu.au/article/september-2020/How-Australias-transition-to-renewable-energy-is-actually-progressing](https://lighthouse.mq.edu.au/article/september-2020/How-Australias-transition-to-renewable-energy-is-actually-progressing). Accessed 29 June 2022.

Green, Natalie. "What Are the Advantages and Disadvantages of Solar Energy?" *news.com.au*, 27 Oct. 2021, [www.news.com.au/best-of/money/what-are-the-advantages-and-disadvantages-of-solar-energy/news-story/1d3c8031dbbf056918900034e76be6e9](https://www.news.com.au/best-of/money/what-are-the-advantages-and-disadvantages-of-solar-energy/news-story/1d3c8031dbbf056918900034e76be6e9). Accessed 29 June 2022.

Mercer, Daniel. "Australians Install Record Amounts of Rooftop Solar Despite Lockdown, Supply Chain Pressures." *ABC News*, 7 Feb. 2022, [www.abc.net.au/news/rural/2022-02-08/record-amounts-of-rooftop-solar-installed-during-lockdown/100805838](https://www.abc.net.au/news/rural/2022-02-08/record-amounts-of-rooftop-solar-installed-during-lockdown/100805838). Accessed 29 June 2022.

Moore, Tony. "Queensland Likely to Oppose Excess Solar Power Fee." *Brisbane Times*, 6 May 2021, [www.brisbanetimes.com.au/national/queensland/queensland-likely-to-oppose-excess-solar-power-fee-20210505-p57p1t.html](https://www.brisbanetimes.com.au/national/queensland/queensland-likely-to-oppose-excess-solar-power-fee-20210505-p57p1t.html). Accessed 29 June 2022.

Perkins, Miki. "Australia Reaches 3 Million Households with Rooftop Solar." *The Sydney Morning Herald*, 9 Nov. 2021, [www.smh.com.au/environment/climate-change/australia-reaches-3-million-households-with-rooftop-solar-20211108-p59721.html](https://www.smh.com.au/environment/climate-change/australia-reaches-3-million-households-with-rooftop-solar-20211108-p59721.html). Accessed 29 June 2022.

Purtill, James. "What Is Renewable Energy Curtailment and How Does it Affect Rooftop Solar?" *ABC News*, 15 Feb. 2022, [www.abc.net.au/news/science/2022-02-16/solar-how-is-it-affected-by-renewable-energy-curtailment/100830738](https://www.abc.net.au/news/science/2022-02-16/solar-how-is-it-affected-by-renewable-energy-curtailment/100830738). Accessed 29 June 2022.

Talberg, Anita. "Support for Renewable Energy." *Parliament of Australia*, 2013, [www.aph.gov.au/About\\_Parliament/Parliamentary\\_Departments/Parliamentary\\_Library/pubs/BriefingBook44p/RenewableEnergy](https://www.aph.gov.au/About_Parliament/Parliamentary_Departments/Parliamentary_Library/pubs/BriefingBook44p/RenewableEnergy). Accessed 29 June 2022.

Wilson, The Hon Tim, MP. "Commonwealth to Invest \$37 million in New High Tech Solar Farm." *Office of the Minister for Industry, Energy, and Emissions Reduction*, 20 Jan. 2022. [www.minister.industry.gov.au/ministers/wilson/media-releases/commonwealth-invest-37-million-new-high-tech-solar-farm](https://www.minister.industry.gov.au/ministers/wilson/media-releases/commonwealth-invest-37-million-new-high-tech-solar-farm). Accessed 29 June 2022.