The Environment Magazine

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The Environment Club

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Message from Editor in Chief

My name is Henry Yao. I am Editor in Chief of the Environment Magazine.

The purpose of this magazine is to provide a platform for students of all backgrounds to express their views on current environmental issues to a broad audience. I believe that every student has the ability to make a positive difference in the world, and through this magazine, we aspire to unleash their potential. The project is open to everyone, and there are unlimited spots available for participation. We welcome all students who want to be a part of this effort.

To contribute articles to The Environment Magazine, please contact playfndn.environment@gmail.com. Volunteer hours will be recognized.

Solar Photovoltaic Power

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In the face of a deteriorating environment and excessive CO2 emissions, many urban and suburban areas of our cities have been increasing their search for methods to incorporate more renewable energy in their daily lives. As one of the most representative technologies in the effort to go green, solar panels are a common go-to and can be found on the roofs of buildings and in parking lots.

No longer a niche method of energy generation, there are two types of solar panels: solar thermal or photovoltaic. This article will discuss details of photovoltaic solar panels, which are more straightforward than solar thermal — they convert light to electricity, while solar-thermal produces heat used in large power plants for electricity. Photovoltaics are clean and silent, and don't need to be processed in plants, making them arguably greener than solar-thermal technology.

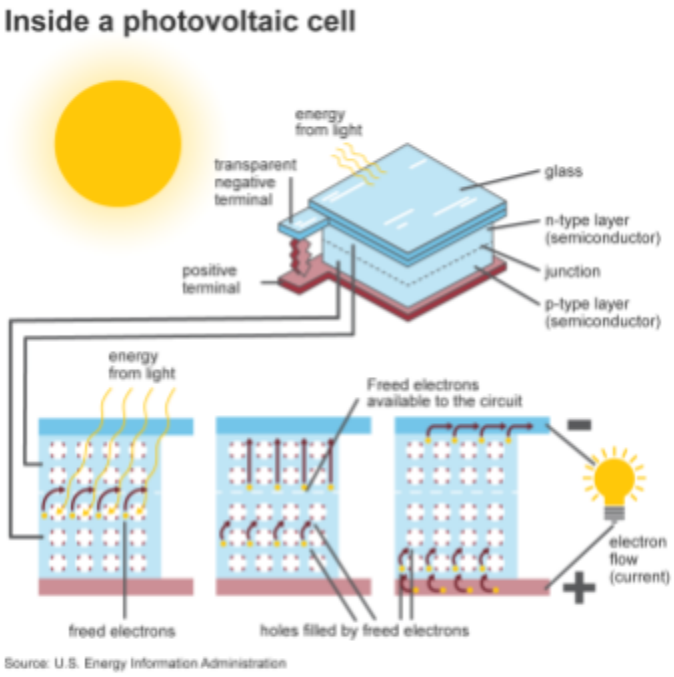

Figure 1. The inner workings of a single photovoltaic cell (source: www.eia.gov)

Photovoltaic cells (PV cells for short) are linked to each other electrically in panels or modules, which may then be combined or connected to form arrays. Arrays can be connected to a larger electric power grid (used to distribute electricity to different places).

Most people are probably familiar with images featuring huge fields of solar panel arrays. The increasing use of solar power helps decrease carbon dioxide and other related emissions, and takes advantage of one of our long-term resources: the sunlight that Earth receives. In an hour and a half, the sunlight that hits the surface of our planet can sustain the world's energy consumption for an entire year.

But it's difficult to harness solar power well. The electricity generated by PV cells is DC — direct current, only directly usable when powering devices that use DC. Since most

large-scale distributions only involve AC (alternating current) electricity, panels and arrays are usually linked to “inverter” devices before the power is sent to the grid, allowing the DC to be converted to AC.

Efficiency has also been a major obstacle in the development of solar panel technology: each cell only generates one to two Watts of electricity, making it necessary to set up huge arrays in open areas to get more electricity. The current industry efficiency of solar panels, in general, is around 15% to 20%, which is already an improvement from 5% in the early 2000s. Labs are constantly working to improve efficiency and have achieved levels of over 50% so far, with high expectations for future advancements.

Figure 2. Photo of a solar panel array (source: news.mit.edu)

Since solar panels rely on the sun, they face the challenge of inconsistency: the sun changes positions throughout the day, and it could even be a cloudy day. It’s expensive to use tracking systems that rotate to match the trajectory of the sun, so panels usually have to be installed at a fixed angle, specialized to their geographical location, to maximize their power throughout the day.

Despite these complications, there have been major improvements in solar power technology, such as continued increases in efficiency and lowered production costs. Given the variability of the power grid, which adds to the constantly-changing electricity market, PV power’s value is often hard to keep consistent. Overall, though, its accessibility has increased in recent years. Along with decreases in the cost of production, it’s very feasible that solar photovoltaics will soon be a widespread source of electricity and replace a substantial amount of fossil fuel power. As a cleaner alternative with low greenhouse gas emissions, PV and solar panel technology is a good investment for those of us with the resources to buy them, and has a promising future in the green energy industry.

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Desalination

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If you look around, water can be found almost everywhere. It's in the oceans, rivers, lakes, soil, skies, and glaciers. It's even in our own homes, supplying us with water for drinking, cooking, and all our other needs. However, this kind of clean water is scarce, considering that more than 96% of Earth's water is contained in the oceans as salt water. Currently, more than two billion people lack easy access to clean water. Luckily, people have come up with innovative ways to convert saltwater into freshwater.

Desalination is the process of turning saline water, water that contains large amounts of dissolved salts, into freshwater. There are two main types of desalination, thermal and membrane. With thermal desalination, seawater is heated up into vapor, leaving the salt and other impurities behind, with the vapor later being collected. For membrane desalination, saltwater is pushed through several filters that remove the unwanted parts. A common type of membrane desalination is reverse osmosis.

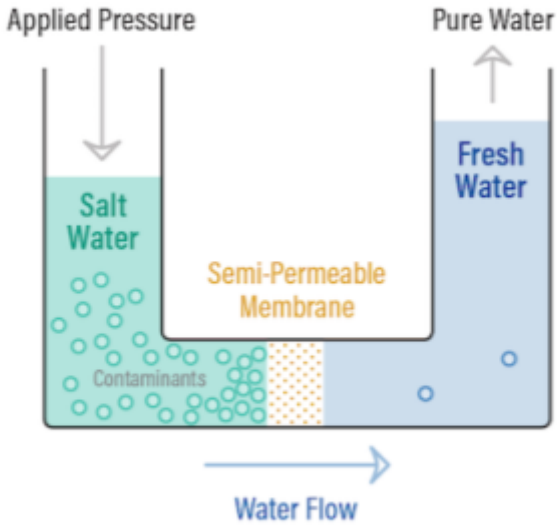

Figure 1: Membrane Desalination *(source: popsci.com)*

Currently, desalination is very commonly done in land-based industrial desalination plants. Worldwide, 173 countries have desalination plants. While globally, the water produced only accounts for 1% of the water used, several counties heavily rely on desalination, especially in the Middle East and North Africa. The largest plant in the world is Ras Al Khair in Saudi Arabia, which produces 1,360,000 cubic meters of water per day. However, these desalination plants bring up several issues. Currently, they use large amounts of energy, often coming from fossil fuels. There have been efforts to reduce the energy used, but the problem has still not been entirely solved. These desalination

Figure 2: Manhat's Floating Solar Still
(source: cnn.com)

plants also produce large amounts of wastewater called brine. Brine is highly concentrated with the salt from the water, and after it is released from the desalination plant, often sinks to the bottom of the ocean and causes ecological damage.

An alternative to land-based desalination plants is solar-powered desalination. One such device is a floating solar still created by the company Manhat. As the structure floats on the ocean, sunlight evaporates the water underneath it, and the water vapor is captured inside the structure, where it eventually condenses. As this structure relies on sunlight, it doesn't require other energy such as fossil fuels. Additionally, it does not produce any brine. However, this 2.25 square meter structure can only produce 1.5 liters, or 0.0015 cubic meters, of water per day, making it very inefficient. Another, more complex, solar-powered desalination system has been developed by researchers at MIT and China. It is a multi-layered solar still that first uses flat panels to absorb heat. Then the heat is transferred to the bottom panel of water, which heats the water into water vapor that condenses on the bottom of the panel of water above it. The heat from the water vapor heats the upper panel of water, which in turn, also becomes water vapor. This process repeats for every layer of the solar still. This system generates 1.5 gallons, or about 0.0057 cubic meters, of water per hour for every meter of solar collecting area. As this structure also relies on sunlight, it doesn't need other energy sources. It is also relatively inexpensive and doesn't produce any brine.

Figure 3: Layered Solar Still *(source: mit.edu)*

Figure 4: Oneka's "Iceberg" Class Buoy
(source: newatlas.com)

Another alternative to land-based desalination plants is wave-powered desalination. An example of this is the company Oneka, which has created wave-powered floating desalination buoys that are mainly built from recycled plastic bottles. When the "Iceberg" class buoys are anchored to the sea floor where the waves are more than a meter tall on average, the buoy absorbs energy from the waves. Then, they use the energy to draw in seawater, where a fourth of it goes through a reverse osmosis desalination system, which converts it to

freshwater. The brine from this process is combined with the other three-fourths of the seawater and released back into the ocean. By not processing so much of the water, it means that the brine is not as concentrated, only about 30% saltier than normal seawater, and the ecological damage is minimized. On the buoy, there are solar-powered sensors that test the quality of the freshwater, and the water is sent back through pipes using the energy gained from the waves. These buoys are designed to produce 30-50 cubic meters of water per day, and should last 15-20 years, with maintenance 3-7 times a year.

More eco-friendly and energy-efficient alternatives to land-based desalination plants are still being created and developed, such as a “Glacier” class buoy from Oneka, which will produce 10 times more water than the “Iceberg” class ones. For now, these small systems can’t rival the enormous desalination plants that churn out hundreds of thousands of cubic meters per day. Still, they can help support local communities without access to reliable electricity but plenty of seawater and sun.

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Why Plastic Should Be Banned in California

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Every year, California spends more than 500 million dollars picking up around five million tons of plastic(oceana.org, Emily Petsko, September 21, 2022). Less than one-fourth of the plastic sold is recycled. Most plastic ends up in landfills as well as oceans. This is a huge threat to our environment, causing many negative effects on our ecosystem. Plastic should be banned in California, for the fact that it causes land, water, and air pollution, is a threat to animals living on land and in the water, and has a negative effect on human health.

Figure 1: Plastic on a beach in Honduras. (source: https://theoceancleanup.com/media-gallery/)

The toxic effects of plastic can harm the Earth's ecosystem. Plastic can release deadly chemicals such as phthalates and Bisphenol A into the soil. Once it seeps into the ground, it can leak into groundwater sources or vegetation (unep.org, December 22, 2021). This leads to humans and even animals to consume the water or plants that are affected. A handful of plastic gets burned too, which releases toxic gasses into the atmosphere due to the fossil fuels it contains. If this keeps going on, the air might be so polluted you might not be able to go outside anymore. Not only does it pollute the land and air, but it also pollutes water. Many plastic-polluted places can include rivers, streams, lakes, and oceans. Since plastic accumulates pollutants in water, these chemicals can spread to other animals. This poses a great threat to our land, water, and air.

Figure 2: Plant growing (source: https://www.conserve-energy-future.com/plant-pollution.php)

Plastic is also a hazard to marine and land animals. These animals can become entangled in or even ingest plastic, causing suffocation, starvation, and drowning. All these problems are a huge concern to these animals. When animals ingest plastic, they are at huge risk of dying or getting sick. If many animals are affected by plastic, they are putting their population in danger. As previously stated, plastic contains toxic chemicals, and animals ingesting these toxic chemicals

results in disease contraction, which can harm and disrupt their reproductive systems. Having a disrupted reproductive system leads to animals producing fewer eggs, and mammals not being able to reproduce at all. If animals fail to reproduce, the population will decline, and animals will slowly become extinct and disappear. Saving animals should be our number one priority as these animals are very crucial to Earth and humanity.

Figure 3: Entangled leatherback turtle. (source: http://www.oceanspirits.org/)

Around 400,000 to one million people pass away each year because of plastic (kff.org, May 14, 2019). Plastic contains chemical additives known to be toxic to the human body. These chemicals can be in the water we drink or the food we eat. When consumed, they can lead to infertility, obesity, diabetes, and prostate or breast cancer (genevaenvironmentnetwork.org, October 12, 2022). Sadly, many people have been affected by these disorders. Some of the rarer disorders include reproductive, growth, and cognitive impairment, as well as damage to neurodevelopment (genevaenvironmentnetwork.org, October 12, 2022). These disorders can greatly impact a human's life, not knowing if they will become impacted or not. Equally important, babies around plastic may accidentally consume it, endangering their lives. Of course, the probability of even getting these diseases from plastic is pretty slim, but we still shouldn't put ourselves in danger. To reduce these deaths, we should ban plastic in California and replace it with something more eco-friendly.

Figure 4: Piles of plastic. (source: https://www.ecowatch.com/plastic-pollution-reduction-goals-unep.html)

Many people argue about whether or not plastic should be banned in California. Some people say they are beneficial, while others say they harm the environment. But, the amount of money California spends on plastic is way more than it should be spending. This money could be going towards something more useful other than plastic. On the other hand, plastic can be replaced with other substitutes including steel, glass, and silicone which is much safer for our planet. Plastic should be banned in California, for the fact that it causes land, water, and air pollution, is a threat to animals living on land and in the water, and has a negative effect on human health.

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Environmentalists in Action

In this issue, we would like to thank the following Environmentalists.

On May 14, 2023, Brian Haapanen, Aiden Mok, Taylor Mok, Henry Yao, and Sean Yue cleaned up Iron Horse Trail between Alcosta Boulevard and Amador Valley Boulevard and the surrounding areas.

On Jun 10, 2023, Brian Haapanen, Joyce Miao, Zara Song, Ethan Tong, Henry Yao, Patrick Zhang, and William Zeng cleaned up Iron Horse Trail between Hacienda Drive and Santa Rita Road and the surrounding areas.

On Jun 24, 2023, Brian Haapanen, Ethan Tong, Patrick Zhang, and William Zeng cleaned up Emerald Glen Park.

On July 22, 2023, Brian Haapanen, Joyce Miao, Taylor Mok, Ethan Tong, Edward Wu, and William Zeng cleaned up Fallon Sports Park.

About

The Environment Magazine is published by the Environment Club. It collects introductory articles on environmental protection written by youth volunteers, with the goal of educating students and parents on how to protect the environment. It aims to provide a platform for all students to express their opinions and inspire change through activism. It also empowers students to become environmentalists and make a positive impact on the world.

The Environment Club is a group of passionate middle and high school students dedicated to environmental protection. We started by organizing youth volunteers to clean up the trails and streets in our local community, and now we're taking the next step by promoting awareness and change through our publication, The Environment Magazine. Our goal is to inspire others to take action and make a positive impact on the environment, both locally and globally. The Environment Club is a subdivision of the PLAY Foundation, a 501(c)(3) non-profit organization.