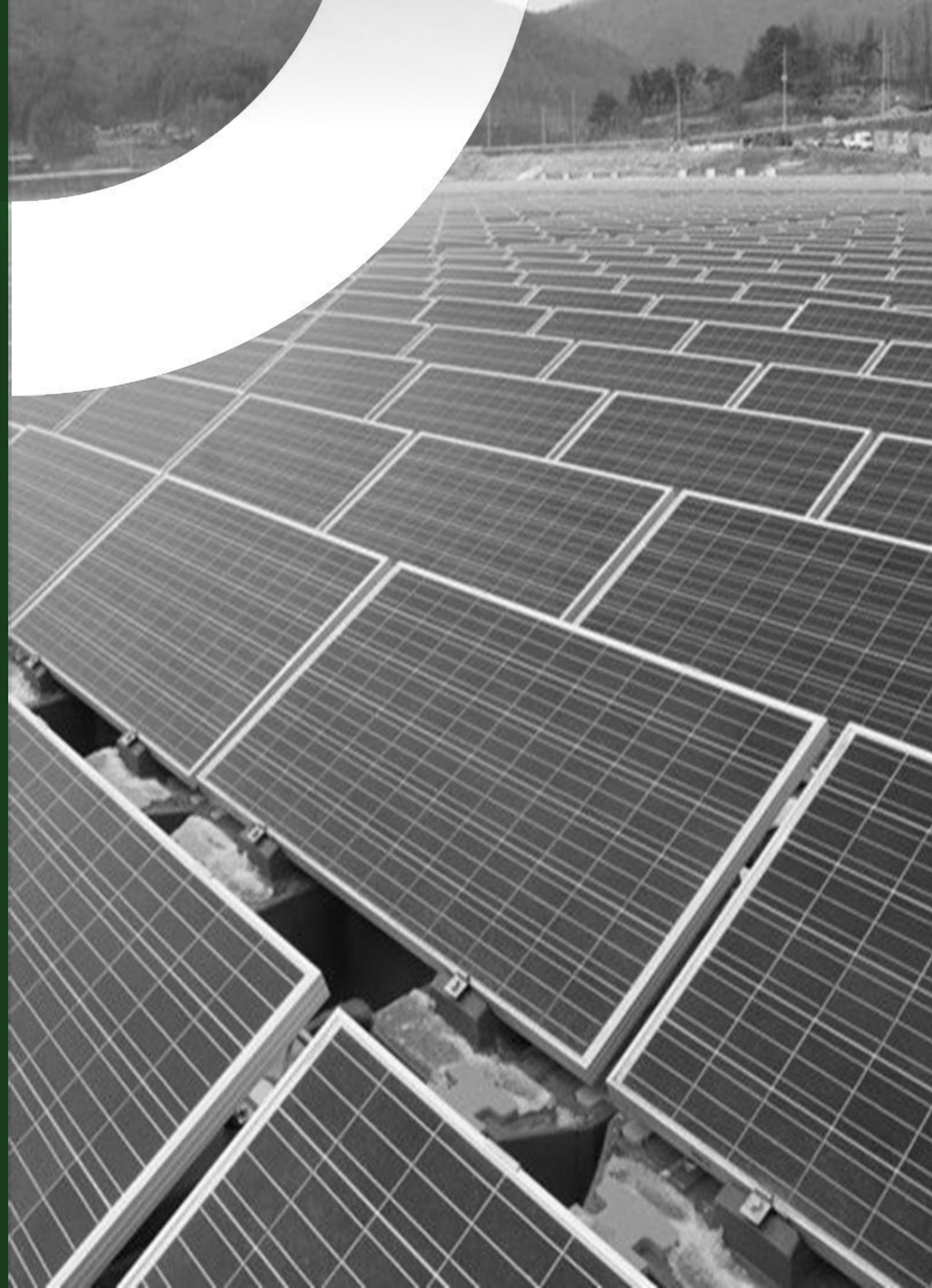
Make It Cooler!
Make It Clearer!
[MICMIC]

Schneider Electric Go Green in the city 2022

Team **Rainism**



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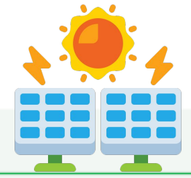
I love EARTH!

We gathered with the one goal “make the Earth more healthy using the facilities the civilization”. For achieving worldwide carbon neutrality, we should produce and manage the renewable energy more efficiently. We decided to use more power of nature than to make something new. Through eco-friendly <MICMIC>, **We can improve generation efficiency of sustainable energy**.

What is our team’s problem statement?

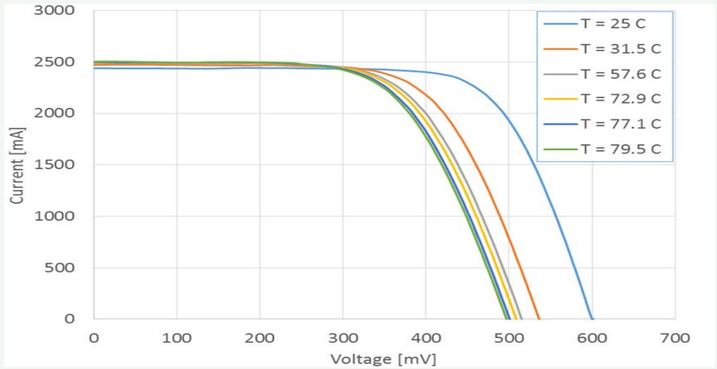


Causes of lowering the efficiency of solar power

Despite the slow expansion of renewable energy due to the spread of COVID-19, renewable energy generation capacity will reach 280[GW] in 2020, up 45% from a year earlier.
The International Energy Agency (IEA) predicts that **new solar facilities will continue to increase** in 2022. (2021: 145[GW]-> 2022: 162[GW])
In addition, large-scale solar photovoltaic(PV) facilities account for 41% of European development projects in 2021.
Solar PV accounts for an average of 55% per year from 2023 to 2025, accounting for a large proportion of energy development worldwide.
We decided to **analyze the causes of lowering solar efficiency and find ways to minimize** them.

Temperature

Solar cells are **vulnerable to heat**. Solar cells have a sharp decrease in current and a sharp decrease in output when they pass a specific threshold of voltage. The power degradation lowers the efficiency of PV power, and if the efficiency falls, the power sales profit finally decreases depending on the amount of PV power.



[Table 1: Relation between Efficiency and Temperature]
The table above is a graph of power by temperature. It can be seen that **the higher the temperature, the lower the power**.

Soiling on solar panels

When contaminants are deposited on the surface of the solar panel, the amount of sunlight incident on the battery is reduced, resulting in a decrease in the efficiency of the solar cell. In particular, bird droppings contain uric acid, which can damage the panel. In addition, dew occurs at dawn in areas with a large daily temperature difference, and when these water meets sand grains lined up in the desert, they become pollutants and are deposited on the surface of the solar cell.
In fact, solar panels are covered with **dust or foreign substances reduce power efficiency** by about 10%, and if the output decreases by 10%, large financial damage of less than 100 million won per year occurs at 1,000 kW solar power plants.

[Figure 1: Foreign substances on solar panel]

Reference: Indoor characterization of a reflective type 3D LCPV system, Hasan Baig(2016)

What is our solution?

Upcycling rainwater

Lower the temperature of the solar panel

Solar PV is **most efficient at temperatures of 25 °C**. However, if the temperature of the solar panel cannot be maintained at 25°C for the aforementioned reasons, energy generation efficiency will inevitably decrease. Also, upcycling rainwater is recycling resources, so no additional energy is required. However, we only use a small amount of power used in the pump. We will increase power generation efficiency by **upcycling rainwater to lower the temperature** of the solar panel.

Remove foreign substances from the solar panel

Foreign substances on the solar panel reduce the efficiency of solar power generation.
Rainwater will flow down the solar panel to remove foreign substances such as **pollen and sand**. Also, we will strengthen the water pressure of rainwater to remove foreign substances that are not easily erased, such as bird droppings on the solar panel.

We propose a solution that increases power generation efficiency by upcycling rainwater to lower the temperature of the solar panel and remove foreign substances from the solar panel.

Why does our solution work?

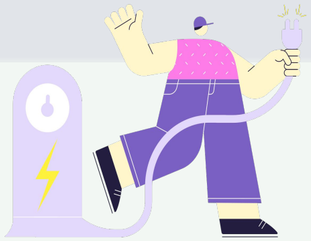
1.Solving the problems of the existing solar module cleaning and cooling system

Minimize initial facility costs

Unlike other auto devices cooling or cleaning panel, it **costs less than existing devices**. Because natural resources are utilized to the fullest, initial facility costs are not high due to minimized civil engineering-related construction and other energy system-related facilities. It consumes less power, less eco-harmful sources.

Minimize power consumption

The most distinctive property of <MICMIC> is it consumes less power. It will need much electric power to cool water. But we just **use the law of nature**; stored water is exposed on night atmosphere.
Also, The operating power of the sensor and pump for operating the solar PV uses the energy obtained through this <MICMIC>.



Recycling contaminated water after cleaning

If existing solar modules flow water used for cooling and cleaning as it is, environmental pollution will occur. However, <MICMIC> can solve the above problem because the water is sent back to the tank, filtered through a filter, and reused.
In addition, this structure **ensures minimum human resources**.

Why does our solution work?

2. Using natural resources for solar module cleaning and cooling system

Upcycling rainwater

The technology of cooling the solar module by spraying water increases the efficiency of the solar cell panel, but in this case, there is a problem that a large amount of water is required when washing. Therefore, to solve this problem, **we used rainwater**, not groundwater or household water supply.

Cool air of the night

By applying a well-insulated material to a tank that stores cool water, the cool water stored in the tank does not absorb heat when the temperature is high and the water in the tank can be lowered when the temperature is low. In this method, the refrigerant used for general cooling is not used, so **greenhouse gases are not emitted**.

Sustainable energy can be realized in this solar PV <MICMIC>.

How will our solution work?

[Figure 2: Main Drawing of <MICMIC>]

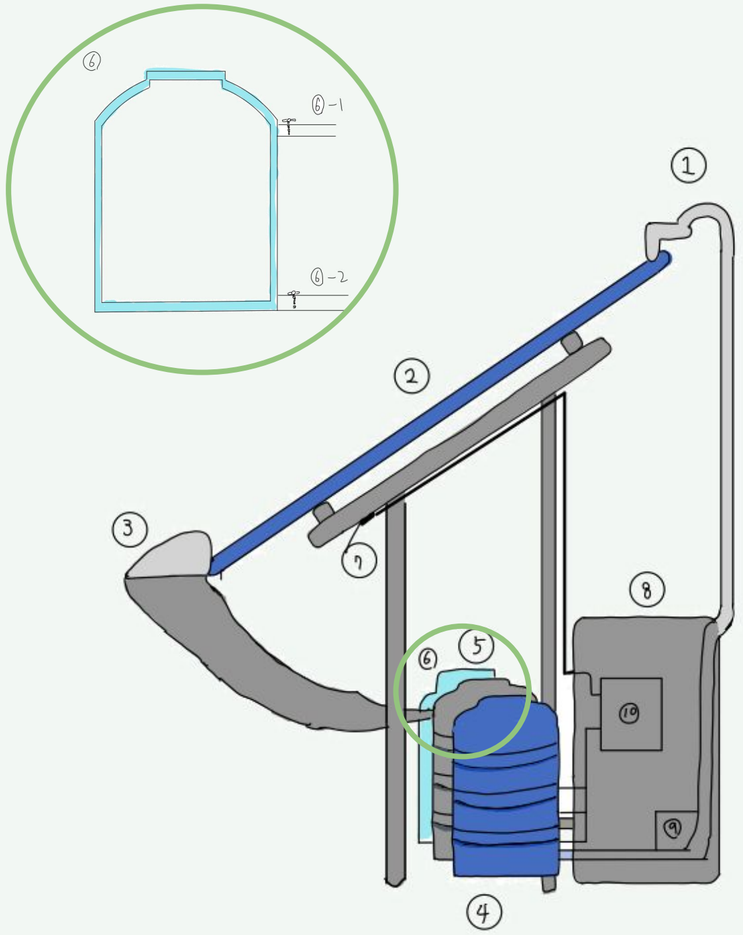
Procedure of <MICMIC>

In the Daytime
- Solar Power Generation
- Clean and Cool the PV panel every setting time
- Default State

In the Nighttime
- Stop circulation
- Cooling the water
- Gather clean and cool water in cool water tank

In the Rainy Day
- Gather rainwater for recycling
- The rainwater is also used for cooling and cleaning
- Less generation but secure amount of water

How will our solution work?



[Figure 3 : Side Drawing of <MICMIC>]

Components

① Water Spray Nozzle
Cooled, purified water is stored instantly to be sprayed for PV. Whenever the set time approaches, the water is **sprayed by high pressure**.

② Solar PV panel
It is used for solar PV. Also it can be **funnel** for gather rainwater.

③ Primary Filter
It blocks big residue like bird droppings and sand. So used water is **primarily purified**. And it goes to water tank.

④ Cool Water Tank
It **keeps cooled water**. It is connected with ⑥ Natural Cooler Tank and with ① Water Spray Nozzle. Surface of this tank **consists of insulator** for constant temperature.

⑤ Unpurified Hot Water Tank
Used water and rainwater is **gathered to this tank**. Dusts, Shares, Fine dusts can be dissolved so it needs to be purified for usage, therefore there is simple **purifier inside**. And there is water level control for preventing overflow.

⑥ Natural Cooler Tank
At night, water of ⑤ moves into ⑥ for cooling. It uses daily temperature range. the area in contact with the air is placed widely for **temperature exchange**. When the temperature approaches the set value, it returns ⑤ tank.

⑦, ⑧ Junction Box

⑨ Water Pump, ⑩ Main Control
It controls all the procedure.

Who is benefitting from our solution?

1. Small power grid

It is difficult to maintain solar PV for the elderly who install and use solar power systems on the roofs of rural houses. Thus, a system for minimal maintenance is required, and this could be an alternative, so even **citizens who replenish power with electric energy generated** after installing the PV system could benefit from <MICMIC>.

2. Large–scale power plant

On a large scale, solar power operators or managers can benefit.
In the case of solar power projects conducted in large areas such as deserts and plains, a lot of manpower is required to manage them. However, using <MICMIC> can increase power efficiency without the need for large manpower. In addition, it will be helpful to install it in areas where traffic access is difficult.
Overall, Our solution will help wherever!