



7.2 Green Energy Products

URECO is part of Taiwan's excellent green energy industry, with a business group that includes solar cells, solar modules, and a new business group (energy storage systems.) URECO has consistently received national recognition, with its solar modules winning the Taiwan Excellent PV for eleven consecutive years (2013-2022 and 2023). Additionally, it achieved VPC (BSMI PV Taiwan Plus) certifications from 2016 to 2023, maintaining its commitment to providing high-quality, high-standard solar energy products.

Note: Please refer to the official website of URECO for the details of green energy products.

Solar Energy Systems

To achieve the United Nations Sustainable Development Goal of ensuring affordable, reliable, and modern energy services for all by 2030, we have set short, medium, and long-term goals as follows:

■ Short-term goals (2024~2025):

Suitable solar power systems (rooftop, agricultural sheds and ground type) are built according to the market demand and utility power supply conditions. Solar power systems are mainly composed of solar cells, power regulators (including inverters, system controllers, and on-grid protection devices), wiring boxes, and storage batteries. According to the type of system, it can be categorized into utility on-grid type, off-grid type and on-grid with batteries type.

1. Stable power supply is available at the site:

Utility On-Grid System is used because it has a stable power supply and can use the solar power system as supplementary power supply, and the excess power supply can be sold back to the local power plant.

2. No utility power support at the site:

Off-Grid System With Batteries is used to store electricity with storage batteries and provide stable power under reasonable power load.

3. The site has stable power supply or intermittent power supply:

On-Grid System With Batteries is a hybrid system that uses a solar photo-voltaic system to generate and store electricity during the day and the utility power to supply electricity at night. The utility and storage batteries are used in combination to obtain stable power.

Our company continues to deploy comprehensive layout according to different site environment (ground type, roof type, all weather court, water surface type, agriculture, fishery and electricity coexistence...) All of them can provide the solar photo-voltaic module products to meet their environment. The products include large size "PEACH VLM" series, M10 and M10 TOPCon modules with better power generation performance and better cost of electricity consumption in large power stations. The double-glass module "Glory PEACH" has better weathering structure, suitable for salt beach area and has high wind pressure and fire resistance. The "PEACH BiFi" series, with lightweight design and high performance on both sides, is suitable for decentralized power stations such as rooftop type.

As the voltage of the system power station increases, there is a higher voltage difference between the module and the ground, which affects the output efficiency of the double-sided module in the long term. In response to this, our company has launched a double-sided battery quality excellence program and won the support and subsidies from the Bureau of Energy, Ministry of Economic Affairs' Industry Energy Program, which aims to improve the battery quality and back power degradation phenomenon. Reliability testing will be conducted by the Industrial Technology Research Institute (ITRI), a third-party institute in Taiwan, to help verify that the product will create greater dual-sided power generation benefits for customers, and is expected to increase power generation contribution by more than 10%. The technology has been filed for patent protection in Taiwan and the U.S., and is planned to be officially launched with the new production line of large-size solar cells to seize the global solar photo-voltaic market.

URECO's energy products are the most powerful and reliable products in their class in the industry of Taiwan. In

response to Taiwan's dual-use land type, URECO has developed full-transparent modules to achieve the goal of agriculture-based and green power adding value; and developed the world's exclusive detachable modules, which have also obtained international IEC product certification.

■ Medium-term goals (2025~2028):

To create a customized and optimized solar system power station. Generally speaking, large-scale ground-mounted grid-connected power systems can be categorized into fixed and sun-chasing systems. Fixed systems are calculated and designed according to the location of the power plant to produce the maximum cumulative amount of electricity throughout the year; sun-chasing systems are rotatable and follow the trajectory of the sun to rotate the angle of the system, increasing the power generation capacity by 20-30% compared to fixed systems. In addition, the sun-chasing system has a dynamically balanced wind protection capability, with a wind speed capacity of up to level 17 gusts, not simply resisting the wind force, but allowing the wind to pass smoothly in response to changes and reducing the possibility of structural damage. Because it can rotate at a full sunlight angle, it is less likely to accumulate dust or water, and the efficiency of power generation can be more stable. URECO is currently focusing on fixed solar power systems. In the near future, URECO expects to introduce more efficient sun-chasing solar power systems to meet the needs of countries around the world with different weather challenges and more efficient power generation.

The government is fully committed to promoting the solar photo-voltaic policy to prioritize the diversified use of land, with the Ministry of Economic Affairs, the Council of Agriculture and the Ministry of the Interior working together to promote the core values of "agriculture and fishery-based, value-added green power", using green energy resources to drive the upgrade and sustainable development of the fishing industry, creating a local employment economy, optimizing the environment for farming technology and sustainable land development and utilization, and promoting the coexistence and prosperity of the fishing industry with green energy. URECO's solar products are designed to support the "farming, power generation, and dual use of land" concept, integrating solar photovoltaic with agriculture and aquaculture. By choosing appropriate crops, this approach creates a symbiotic relationship between agriculture (aquaculture) and green energy, promoting mutual prosperity and coexistence with diverse benefits.

Retirement of solar modules has become a growing economic and political issue, and according to a study by the IEA (International Energy Agency), the world will accumulate more than 6 million tons of waste by 2030. The Ministry of Environment surveyed that Taiwan will accumulate more than 10,000 tons of waste (regular retirement or disastrous disposal) by 2025. In response to the international trend of net-zero carbon emissions, URECO and ITRI are accelerating the development of easily detachable solar modules to achieve product standardization, introducing new technologies and upgrading Taiwan-made high-quality products, leading the energy industry toward net-zero sustainable development, grasping new business opportunities in the global carbon reduction cycle, accelerating the research and development of related issues in technology for international marketing and market promotion, and providing The best solution to the solar module recycling issue.

The Company is capable to fully integrate cells and modules, we match different environment with appropriate cells and products according to characteristics, be it water surface, desert, snowland or rooftop. Our R&D team has been maintaining good cooperation with domestic and foreign academic and research institutions to obtain information on the development of various new technologies and equipment, and has established a close network with upstream key material suppliers to provide complete technical service and support to our downstream customers.

■ Long-term goals (2028~2038):

Promote local economy to improve life, global, environmental protection and carbon reduction, nuclear power plant retirement. With the widespread application of solar energy systems in local agricultural and livestock sheds, apart from the income from the agricultural and livestock industry itself, the income from the value-added land, the income from the sales of electricity from solar power generation, and even the income from the resale of solar power plants can improve the existing quality of life and promote the local economy. In addition, the international trend of energy saving and carbon reduction and the issue of carbon trading have attracted much attention from all parties. By replacing the use of traditional fossil energy through the integration of solar power generation into the power grid, it has become an important source of carbon reduction performance recognized by the Kyoto Protocol and the

European Union.

Unlike other types of large-scale power plants, solar power plants do not cause any environmental or noise pollution and can be safely located in any place. In recent years, URECO has been dedicated to the planning and installation of solar power plants, and has achieved high performance and rating in countries around the world.

■ Solar Energy System Performance:

The Company is the largest developer and constructor of solar power systems in Taiwan, with a business model that focuses on system business and module branding to actively develop and construct solar power systems and provide asset management services for power plants. As for overseas, the Company has formed strategic alliances with several internationally renowned renewable energy asset management companies to sell projects to asset management companies after they have reached the construction stage (or even the completion stage), taking into account the Company's strengths in site development. This strategy has yielded immediate results, with over 600MW of accumulated solar sites completed worldwide. In Taiwan, as we have manufacturing plants, offices, or stationed offices in Hsinchu, Miaoli, Tainan, and Kaohsiung, we are actively participating in local school bidding projects in nearby counties and cities, and conducting local presentations and green energy education visits to further expand our system business in Taiwan by combining our strengths in system engineering and module manufacturing. In 2023, the Company invested NT\$1.504 billion in solar power plants, achieving a total installed capacity of approximately 31.56 MW and reducing carbon emissions by about 19,754 tons.

Solar photovoltaics represent a clean and sustainable renewable energy source. The photovoltaic modules used in our nation's solar power facilities adhere to international standards (IEC), ensuring reliability and durability with a lifespan of over 20 years while maintaining 80% efficiency. Consequently, after the 20-year preferential purchase agreement with Taiwan Power Company expires, the original systems can still generate electricity for self-use or be sold to private enterprises or Taiwan Power Company. Alternatively, higher-efficiency photovoltaic modules can be installed for continuous operation, preventing the original sites from becoming idle. Regarding the recycling of photovoltaic panels, a recycling and utilization mechanism has been established in collaboration with the Ministry of Environment, which includes setting up a module recycling fund. Installers are required to prepay module recycling fees (NT\$1,000/kW). To date, URECO has prepaid NT\$6,143,118 for module recycling fees. Each module is assigned a number and tracked. When photovoltaic operators or site owners need to dispose of waste modules, they can call the Ministry of Environment's module recycling consultation hotline (03-582-0009) for removal assistance. Furthermore, continuous development of reuse technologies enables high-value processing of the separated glass, metal, and plastic from crushed modules, thereby enhancing recycling rates and benefits.

Note: Information on the photovoltaic module recycling fund is sourced from the Ministry of Economic Affairs press release (https://www.moea.gov.tw/mns/populace/news/News.aspx?kind=1&menu_id=40&news_id=99014).

Installed Capacity by Year from 2020 to 2023

2020 Installed Capacity / 19.89MW

Item	Solar Power Generation System	Installed Capacity (MW)
1	Taipei	0.41
2	Tainan	4.71
3	Kaohsiung	10.82
4	New Taipei	0.26
5	Hsinchu	1.16
6	Miaoli	0.27
7	Yunlin	0.95
8	Changhua	1.31

2021 Installed Capacity / 14.19MW

Item	Solar Power Generation System	Installed Capacity (MW)
1	Tainan	0.90
2	Taoyuan	1.98
3	Kaohsiung	7.99
4	New Taipei	1.07
5	Hsinchu	0.38
6	Chiayi	0.38
7	Pingtung	1.49



2022 Installed Capacity / 55.8MW

Item	Solar Power Generation System	Installed Capacity (MW)
1	Taipei	1.10
2	Tainan	3.34
3	Yilan	1.53
4	Taoyuan	19.86
5	Kaohsiung	9.61
6	New Taipei	9.73
7	Hsinchu	8.45
8	Chiayi	2.18

2023 Installed Capacity / 31.56MW

Item	Solar Power Generation System	Installed Capacity (MW)
1	Tainan	0.89
2	Yilan	13.51
3	Taoyuan	7.62
4	Kaohsiung	3.27
5	New Taipei	1.54
6	Hsinchu	2.14
7	Yunlin	0.59
8	Changhua	2.00

Example of continuous operation of solar power system performance by the end of 2023 (built in 2020)

1

Hsinchu Science and Industrial Park reservoir-Zhunan Miaoli

873.28 kWp



2

Honinco Honex Industry Corp. Changhua

1,308.2 kWp



3

AirTAC phase 3 Tainan

672.7 kWp





4

Houbi – Xiajiadong Section
Tainan
2,039.49 kWp



Example of continuous operation of solar power system performance by the end of 2023
(built in 2021)

1

Kaohsiung Cijin Life
Memorial Kaohsiung
756.86 kWp



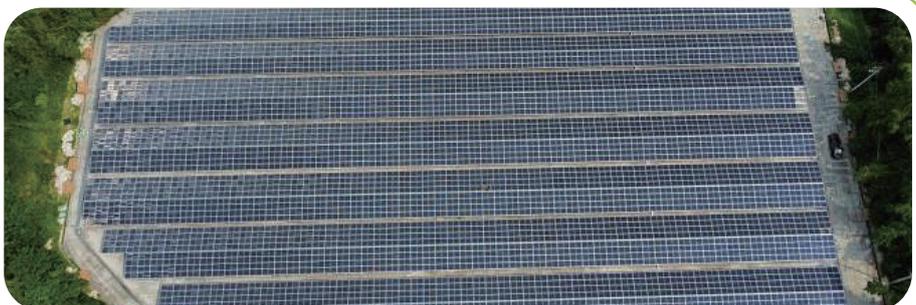
2

Taiwater7_Pingding
Water Purifying Plant
Kaohsiung
2,129.4 kWp



3

Taiwater7_Shenshui
reservoir Kaohsiung
1,491.84 kWp



4

Taiwater7_Gangxi Water Purifying Plant Kaohsiung

491.4 kWp



5

Taoyuan Municipal Taoyuan Senior High school Taoyuan

1,772.43 kWp



6

Baoshih Elementary School Hsinchu

379.44 kWp



7

Kaohsiung Fifth bid_ Hsin Chya Elementary School Kaohsiung

423.06 kWp



8

Kaohsiung Fifth bid_ Kopei Elementary School Kaohsiung

494.01 kWp





Example of continuous operation of solar power system performance by the end of 2023
(built in 2022)

1

Taiwater2_Guanyin above
reservoir Taoyuan
847.56 kWp



2

Taiwater2_Danan Water
Purifying Plant Taoyuan
1,123.08 kWp



3

Taiwater7_Fengshan
West Water Purification
Pool Kaohsiung
2,939.16 kWp



4

Taiwater7_Fengshan East
Water Purification Pool
Kaohsiung
2,846.76 kWp



5

Neihu Repair Factory_
Roof type Taipei

1,103.52 kWp



6

SinGuang Elementary
School Roof type
Kaohsiung

460.70 kWp



7

Hsinchu county_Zhubei_
Chupei Junior High
School Hsinchu

792.2 kWp



8

XiuLang Elementary
School Roof type
Newtaipei

1,609.25 kWp





Example of continuous operation of solar power system performance by the end of 2023
(built in 2023)

1

Wujie Landfill, Yilan
8,541.115 kWp



2

Liuzigou Section, Erlin
Township Office, Changhua
1,999.98 kWp



3

Xinhua Fruit and Vegetable
Market, Tainan
894.54 kWp



4

Shenkeng Elementary
School, New Taipei
441.78 kWp



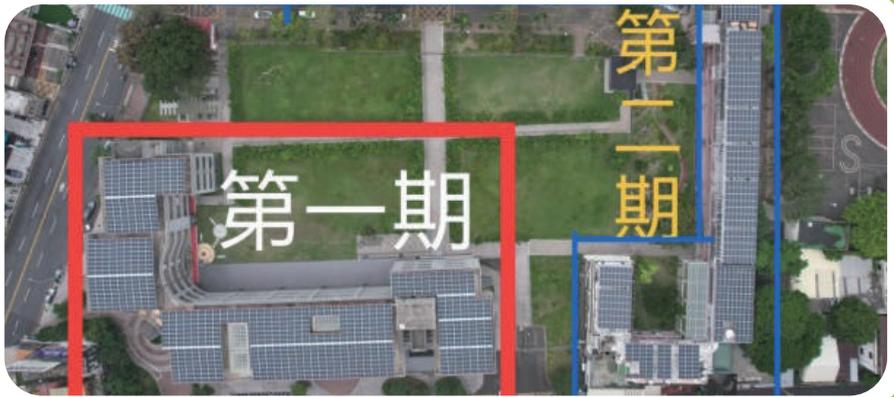
5

CPC Siaogang Plant,
Kaohsiung
1,974.15 kWp



6

Guangwu Junior High School,
Hsinchu City
752.21 kWp



7

Yuan Ze University, Taoyuan
1,250.5 kWp



8

Walton Advanced
Engineering - B15, Kaohsiung
324.7 kWp





Solar Module

Short, medium and long term goals for solar modules

Short-term goal: (2023~2024)

Our Company has made comprehensive layout according to different site environment (ground type, roof type, all weather court, water surface type, agriculture, fishery and electricity coexistence...) All of them can provide the solar photo-voltaic module products to meet their environment. The products include large size "PEACH VLM" series, M6 and M10 modules with better power generation performance and better cost of electricity consumption in large power stations. The double-glass module "Glory PEACH" has better weathering structure, suitable for salt beach area and has high wind pressure and fire resistance. The "PEACH BiFi" series, with lightweight design and high performance on both sides, is suitable for decentralized power stations such as rooftop type.

We are committed to developing new high-efficiency solar photovoltaic modules. Over the past two years, we introduced the large-format "High-Efficiency PEACH VLM" series, achieving power outputs of 390W (M6/120), 460W (M6/144), 420W (M10/108), 470W (M10/120), and 560W (M10/144). These modules are leading in efficiency within Taiwan's market. The M10 PEACH VLM single and dual-sided modules entered trial production in early 2023 and successfully completed reliability and performance testing by the third quarter, earning both IEC and VPC certifications. Additionally, they were verified by the 11th Excellent Photovoltaic Product Selection (Golden Energy Award), passing rigorous mechanical strength composite tests and PID192-hour tests, making them high-performance and reliable photovoltaic products. Addressing concerns about potential water pollution from solar panels, URECO conducted "crushed modules" immersion tests at the Industrial Technology Research Institute (ITRI) and SGS Testing Center. These tests, which examined 25 items including 8 heavy metals, general metals, and organic compounds, confirmed that "the water quality is safe and non-toxic, with all results significantly below the standards set by the Ministry of Environment." The modules also passed the REACH SVHC 211 items test and the RoHS hazardous substance restriction assessment, proving them to be environmentally friendly and dispelling the myth that submerged solar panels cause pollution. Electromagnetic compatibility (EMC) is the study of the harmful effects caused by accidental electromagnetic energy. We have conducted the EMC standard EN IEC61000-6-1:2019 and EN IEC61000-6-3:2021 tests by TUV Rheinland and passed the relevant tests successfully. In addition, in response to the special environment in Taiwan, our super salt-resistant modules are the first to pass the "toughest" acidic salt spray accelerated aging test IEC 60068-2-52 Severity 8 (salt spray test level 8) by the Industrial Technology Research Institute (ITRI), and pass the PID 300 hours test in a strict sequence. The super salt resistant material also passed the CASS 288 hours (ASTM B368 copper salt accelerated acetic acid salt spray test), making us the only supplier in Taiwan to meet both comprehensive high-strength salt resistance and PID testing standards. This establishes a high-quality benchmark in the industry.

URECO's large size modules (PEACH VLM) are designed in response to the typhoons and rains in Taiwan, using superior frame materials and reinforced cross-sections design than overseas, and insisting on material standards in module material specification. In addition to excellent performance in salt damage resistance, the products are tested in the highest level wind tunnel at ITRI and passed (>17 wind speed) wind site verification, providing customers with better service and product quality assurance, creating a win-win situation. URECO's energy products are the highest power and the best reliability in the industry in Taiwan. In response to the dual-use land type in Taiwan. To address customer needs and market competition, we are planning and developing next-generation N-type TOPCon high-efficiency solar cell modules. By incorporating M10 N-type TOPCon cells and related materials, we anticipate increasing module power output by about 20 watts or more.

Mid-term goal: (2024~2025)

By increasing the cell area and corresponding module size, we further increase the frontal power generation. The adoption of large 166mm and 182mm monocrystalline cells boosts the maximum output wattage of a single module to a positive tolerance of the rated value. This increase in output wattage for individual modules can reduce the Balance of System (BOS) costs for large-scale projects, thus lowering the cost of electricity generation. URECO is the first company in Taiwan to fully implement and mass-produce bifacial cells and modules. Bifacial modules provide



more effective power generation areas and can efficiently utilize ambient reflected light to increase system power output. Our previously launched bifacial dual-glass modules were highly acclaimed for their bifacial power generation benefits, which exceeded expectations. Combining these bifacial power generation products with newly developed M10 TOPCon technology will further enhance photovoltaic conversion efficiency, achieving optimal power generation within Taiwan's limited land area.

The government is fully committed to promoting the solar photo-voltaic policy to prioritize the diversified use of land. The Ministry of Economic Affairs, the Council of Agriculture, and the Ministry of the Interior are working together to promote the core value of "agriculture and fishery-based, green power with added value", to promote the upgrade and sustainable development of the fisheries industry with green energy resources, to create a local employment economy, to optimize the breeding technology environment, to sustain the development and use of land, and to promote the co-prosperity of the fisheries industry and green energy. URECO's module products meet the requirements of "farming, power generation, and dual-use of land" by combining solar photo-voltaic with agriculture (fishery) and selecting suitable crops to create a diversified value of coexistence between agriculture (fishery) and green energy.

It has become an economic and political issue for the retirement of solar modules, and a study by the IEA (International Energy Agency) indicates that the world will accumulate more than 6 million tons of waste by 2030. The Ministry of Environment surveyed that Taiwan will accumulate more than 10,000 tons of waste (conventional retirement + disastrous disposal) by 2025. In response to the international trend of net-zero carbon emissions, URECO and ITRI are accelerating the development of easily detachable solar modules to achieve product standardization, introducing new technologies and upgrading Taiwan-made high-quality products, leading the energy industry toward net-zero sustainable development, grasping new business opportunities in the global carbon reduction cycle, accelerating research and development in related issues for international marketing and market promotion, and providing the best solution to the solar panel recycling issues.

In response to the global market's keen demand for high-efficiency, high-power generation products, high conversion efficiency is especially suitable for Taiwan's densely populated and limited land environment. Higher conversion efficiency per unit area means achieving the required power generation using less land. Taiwan's industry and academia are also investing in developing N-type (HJT heterojunction/TOPCon tunneling oxide passivated contact) cells. In the second half of 2023, our company invested in the mass production line for M10 N-type TOPCon cells. We plan to launch new M10 N-type solar modules with higher photovoltaic conversion efficiency in 2024 and aim to obtain various international and domestic product certifications.

Long-term goal: (2025~2026)

The Company has a complete cell and module technology integration capability to match different battery and product characteristics for different environments, including water, desert, snowlands and rooftops, and the R&D team has always maintained good collaboration with academic and research institutions in Taiwan and abroad to obtain information on the development of various new technologies and equipment at any time, and has established a close network with upstream key material suppliers to provide complete technical service and support to our customers. Our goals include mass-producing high-efficiency and highly reliable bifacial N-type TOPCon modules, developing commercialized next-generation detachable modules, MIT (Made in Taiwan) local modules, and lightweight composite rooftop modules.



Solar Module Goals and Achievements over the Past 3 Years

Item	2021	2022	2023
Short-term goal (One year)	<ul style="list-style-type: none"> - Large size M6 high efficiency single crystal PEACH VLM series (144) module: 460W → VPC certification obtained in March 2022 	<ul style="list-style-type: none"> - Development of large-size high-efficiency M10 PEACH VLM single-sided modules - Detachable module PEACH RE obtained IEC certification → IEC certification obtained in January 2023 - Fully transparent modules obtained VPC certification, planned for mass production in Q3 2023 → VPC certification obtained, ready for mass production 	<ul style="list-style-type: none"> - Large-size high-performance M10 PEACH VLM single-sided modules have obtained IEC/VPC certification - Large-size high-performance M10 PEACH
Mid-term goal (2 years)	<ul style="list-style-type: none"> - Large-sized and high-performance M10 PEACH VLM series module with 144 cells, achieving 550W → Achievement rate: 100% 	<ul style="list-style-type: none"> - Certification achieved for the large-sized, high-performance M10 PEACH VLM dual-sided module. - PEACH RE, a detachable module, certified with VPC certification. 	<ul style="list-style-type: none"> - Mass production of large-sized, high-performance M10 PEACH VLM single-sided modules. - Mass production of large-sized, high-performance M10 PEACH VLM dual-sided modules. - Development of M10 N-type TOPCon modules.
Long-term goal (more than three years)	<ul style="list-style-type: none"> - High-efficiency N-type modules - Successful mass production of detachable modules - MIT-developed local modules - Lightweight modules utilizing composite materials 	<ul style="list-style-type: none"> - High-efficiency N-type modules - Development of large-sized M6 detachable modules - Development of large-sized M10 detachable modules - Lightweight modules incorporating composite materials 	<ul style="list-style-type: none"> - M10 N-type TOPCon GLORY dual-sided modules certified and in mass production. - M10 N-type TOPCon PEACH dual-sided modules certified and in mass production. - Development of commercially viable next-generation detachable modules. - Development - Development of new stacked battery module technologies.

Solar Module Certification.

URECO's solar modules are all certified by international standards such as TUV SUD (IEC 61215/IEC 61730), TUV RH (IEC 61215/IEC 61730), VDE (IEC 61215/IEC 61730), UL (UL 1703/UL 61215/UL 61730), CE, IEC 62716 ammonia resistance standard, IEC61701 severity 8 salt resistance standard; awarded Taiwan Excellent PV (2013-2023) for eleven consecutive years, Energy Administration, Ministry of Economic Affairs solar module products registration; and obtained VPC (SMI PV Taiwan) from 2016 to 2023, we will continue to provide the highest quality products to the society and remain a high quality solar module supplier.

Solar module product introduction: Please refer to the official

https://www.urecorp.com/Product_solarpower_module.php#fixed



Solar Cell

Solar cells can be divided into two major systems: polycrystalline and monocrystalline, depending on the crystal structure of the material. Monocrystalline solar cells and modules have become the mainstream products in the solar market due to their good conversion efficiency, high stability, and mature and efficient value chain. The first generation of polycrystalline solar products have been phased out of the market due to their relatively low efficiency, and URECO has continued to focus on the development of monocrystalline high-efficiency solar cells in recent years, and has been introducing cell products that are ahead of the industry in Taiwan over the years.



■ Short-term goal:

We continue to invest in various researches on existing cell products to improve the Photo-voltaic conversion efficiency of cells through process integration, introduction of new materials and optimization of production parameters to maintain our technological leadership. In response to the global market's strong demand for high efficiency and high wattage, the Company has also invested in a new M10 (182 mm*182 mm) large-size cell mass production line. Through the introduction of large-sized M10 wafers, the refinement of cell patterns, and the application of new technologies, the mass production efficiency of the new M10 P-type PERC cells has now reached 23.3%, approaching the theoretical efficiency limit. Additionally, our company is actively researching the next-generation N-type high-efficiency solar cell process known as Tunnel Oxide Passivated Contact (TOPCon). In the second half of 2023, we will launch the M10 TOPCon cell production line. By upgrading the existing M10 PERC equipment and adding some critical TOPCon process equipment, we plan to start tuning and trial production in early 2024, with mass production anticipated in Q2.

Ensuring the long-term reliability, stable power generation lifespan, and high conversion efficiency of our products is another key focus of our R&D. In 2023, our company received further recognition from the Industrial Development Bureau of the Ministry of Economic Affairs. Our proposed project for the development and field verification of large-sized M10 N-type high-efficiency solar cells and dual-glass modules received a two-and-a-half-year subsidy and guidance, supporting the national energy transition policy towards net-zero emissions by 2050.

■ Mid-term goal:

Monocrystalline silicon solar cells can be further subdivided into P-type and N-type solar cells depending on the composition of the wafers, and PERC have become the mainstream product in the current market due to its sophisticated production process and large and stable machine capacity, and its cost advantage. However, the photo-voltaic conversion efficiency (power generation capacity) of PERC cells is already close to the theoretical efficiency of 24.5%, and P-type wafers have their inherent material defects, so the development and application of N-type cells have been gradually favored in the market. N-type cells can be divided into two main axis according to the product technology: TOPCon and HJT, both of which can reach a theoretical efficiency of 27.5% or more, and both of which have advantages over P-type PERC cells in terms of low temperature factor, low power degradation, and higher dual-side power generation. Combined with the dual-sided module technology, both can contribute to higher wattage and return on investment for solar power plants, while taking into account the reliability of the product. The development of these two high-efficiency N-type next-generation solar cell technologies will be the focus of URECO's medium-to long-term research and development efforts. However, both TOPCon and HJT technologies present significant challenges. The TOPCon process involves multiple steps and high temperatures, leading to lower production yields and higher production costs. Additionally, HJT process equipment is not compatible with the current mainstream PERC, posing higher technical barriers and requiring substantial initial equipment investments. Both technologies necessitate significant R&D manpower and resources. Our company invested in the M10 TOPCon cell production line in the second half of 2023, with mass production expected in Q2 2024. The cell mass production efficiency is projected to exceed 24%. We also plan to obtain VPC certification for the modules in the second half of 2024 and officially introduce high-power (570 watts), high-reliability dual-glass modules to the Taiwanese market.

■ Long-term goal:

The R&D team has maintained good collaboration with academic and research institutions in Taiwan and abroad to obtain information on the development of new technologies and equipment, and has established a close network with key upstream raw material suppliers to provide complete technical services and support to downstream customers. Calcium titanite cells with higher conversion efficiency and potential for stacking with silicon-based cells are a long-term focus for URECO. We will continue to work with legal entities (such as ITRI, Metal Industries Research & Development Centre, etc.) and academic research institutions (such as National Taiwan University, National Tsing Hua University, National Cheng Kung University, etc.) to develop these products.



Solar Cell Products: Please refer to the official website

https://www.urecorp.com/Product_solarpower_battery.php#fixed

Year
2021

R&D Achievements:

1. Enhance the efficiency of the "Black series" cells, achieving an average mass production conversion efficiency of 22.9%.
2. Enhance the efficiency of the "BiFi" cells, achieving an average mass production conversion efficiency of 22.9%.

1. Enhance the efficiency of the "Black series" cells, achieving an average mass production conversion efficiency of over 22.95%.
2. Enhance the efficiency of the "BiFi" cells, achieving an average mass production conversion efficiency of 22.95%

Year
2022

Year
2023

1. Enhance the efficiency of the "Black series" cells, achieving an average mass production conversion efficiency of over 23.3%.
2. Recognized by the Industrial Development Bureau of the Ministry of Economic Affairs, having passed a two-and-a-half-year industrial innovation project.
3. The M10 TOPCon cell production line will be introduced, with mass production set to begin in Q2 2024.



Product Responsibility

URECO understands that solar cell and module products have certain risks, such as the impact of chemicals on the environment during the manufacturing process and the recycling process after the product reaches the end of its life cycle. Therefore, with many considerations, URECO has become a member of PV CYCLE, an international photo-voltaic organization, by explaining the potential risks of its products in marketing through its corporate website, printed product specifications, and trade shows, as well as meeting the regulatory, environmental, and customer requirements of each sales region, in order to ensure that URECO's energy modules are properly recycled, etc., and to ensure and provide the best product service and quality assurance to our customers. URECO energy products have obtained the following relevant certifications:

-  PV CYCLE member of the international photo-voltaic organization: Ensuring that URECO energy modules can all be properly recycled
-  Received many international product certifications from TÜV Rheinland, TÜV SÜD, VDE, UL, etc.
-  Solar module awarded Taiwan Excellent PV(2013-2023) for eleven consecutive years
-  Solar module acquired VPC (BSMI PV Taiwan Plus)
-  Bloomberg Tier 1 Solar Panel Ratings

R&D Planning

URECO's talented technical team has 20 to 30 years of experience in solar cell research and development, covering upstream and downstream silicon materials and wafer manufacturing, cell components, module packaging and system applications. URECO plan to mass-produce M10 TOPCon cells in Q2 2024, with an initial average production

efficiency expected to exceed 24.0%. In the second half of 2024, we will obtain the module VPC certification, officially launching high-power (570 watts), high-reliability dual-glass modules in the Taiwanese market.

URECO is also actively collaborating with domestic and foreign research institutions and is cautiously forming strategic alliances with domestic and foreign industry players on technology. URECO is actively laying out its patented technologies, with a total of 134 patents as of the end of 2023 (cumulative number of patents held for R&D).

	2021	2022	2023
Number of Patents Granted (Cumulative)	117	144	134

Note: In 2023, 2 new patents were granted, while 12 patents expired due to term expiration or other reasons

New Business Group (Energy Storage System)

URECO completed Short-term goal: To build energy storage sites and new energy storage equipment for solar photovoltaic power stations due to excess capacity.

Medium-term goal: To actively develop a combination of containerized energy storage products to support the top-of-the-line dReg0.25 frequency regulation service for the Taipower electricity trading platform.

Long-term goal: To participate in the construction of distribution and transmission level storage sites, providing products and services at different levels from 5 MW to over 100 MW.

