



NATURE ENERGY

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01 Mission and Vision

Vision: to empower a brighter future with the affordable carbon-free energy.

Mission: to become a top-notch thin-film solar module manufacturer and a leading BIPV solution provider worldwide.



02 About us

Business Profile

Advanced Solar Power (Hangzhou) Inc. (here in after referred to as "ASP") was founded by international PV scientist Professor Wu Xuanzhi and his team in May 2008. Since the very beginning, ASP has never been off-track from its strategy: Independent Innovation and Technology Driven. ASP is committed to take Cadmium-Telluride thin film solar cell technology from laboratory to the mass production in China with higher conversion efficiency and lower cost. In 2015, ASP became the first chinese company that can massively produce CdTe thin film PV module product. As of today, ASP's proprietary technology is in the top-tier group both at home and abroad.

Today, with relatively high efficiency and stability, ASP is capable of providing standard CdTe thin film modules and "turn-key" PV solutions to its clients in both domestic and foreign markets. The landscape of ASP's operation includes: R&D for CdTe thin film solar cell technology, production equipment manufacturing, production line and technology transferring, production and sales, and EPC for PV power stations. With a joint-venture company founded in 2016, ASP also extended its business operations in investing and operating PV power stations in China.

ASP's R&D team is well-founded and led by a group of talented and well experienced chinese scientists in PV field. In past 10 years, ASP has set up a three-tier structure for R&D that consists of R&D on fundamental and core technology, R&D on production technology and international research cooperations. With this structure, ASP can not only provide its proprietary CdTe technology to partners, but also take the technology further by incorporating the latest development of the CdTe PV technology in the world.

In 2016, ASP started its quest in BIPV application. During the past 8 years, In alliance with hundres of well-known architecture design teams across the global, ASP is being accepted as a trustworthy partner and as well an innovative solution/sevice provider in the construction industry. ASP was honored to participate over one hundred landmark projects such as China Hall of World Garden Expo 2019 and Datong Future Energy Tech Hall. The efforts helped ASP build its brandname in the construction industry as a Pioneer fo BIPV application.

ASP is willing to further strengthen cooperations with partners who are interested in providing the most affordable PV power solutions to the world by using CdTe thin film solar cell technology. ASP believes that by working side by side, ASP and its partners can write a new chapter in PV production and application markets, and strive to build resource-saving and environmental-friendly societies worldwide.



Business Overview

ASP Production



The first generation production line



The second generation production line



Experimental line

Production Lines

ASP has a self-developed cadmium telluride thin film solar technology with completely independent intellectual property rights, and fully has the ability to industrialize cadmium telluride thin film solar energy.



Business Overview



Business Overview

Honors and Rewards



In June 2014, Awarded by the United Nations as "2014 Global Top Investment Scenarios to Apply New Technologies for Renewable Energy Utilization" Blue Sky Award



In October 2016, In the 16th China Photovoltaic Conference (CPVC16), Mr. Wu xuanzhi was awarded "China solar photovoltaic achievement award".



Formulated by the Ministry of Science and Technology, ASP was the main executing unit of the "Research on Large-scale Production Technology and High performance of Cadmium Telluride Solar Cells".



In December 2016, ASP won the 2016 national distributed photovoltaic application Best BIPV Building Component Award



In December 2017, ASP won the domestic annual photovoltaic industry award "2017 Best Public Building Distributed Photovoltaic Project Gold Award"



The 2nd National Distributed PV Application Innovation Gold Award in 2017, Gold Award for Best Public Building Distributed Photovoltaic Project



In 2017, ASP won high-tech enterprise certificate



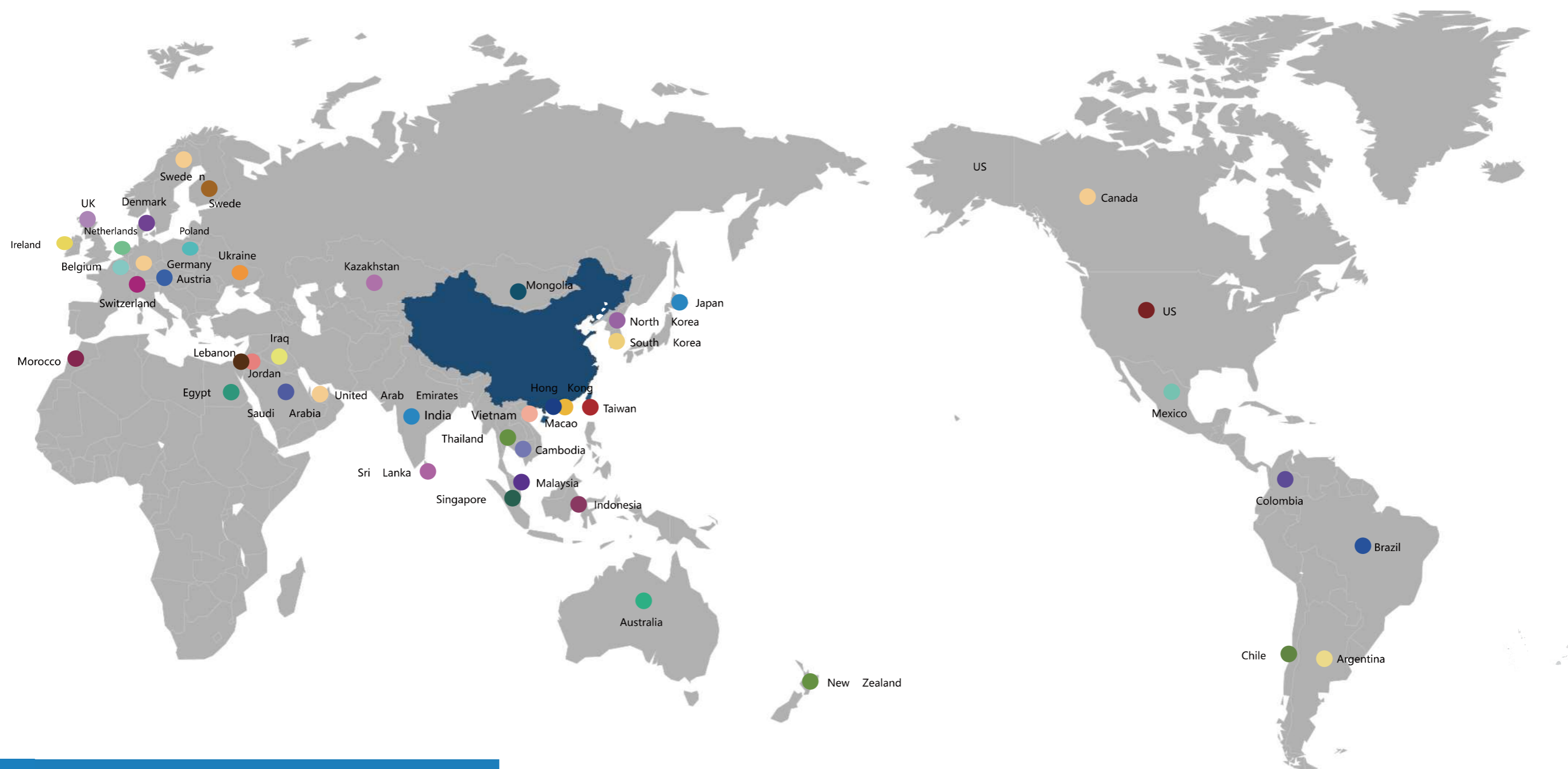
In August 2017, ASP was awarded "China Green Energy Contribution Enterprise"

Certification

ASP's solar module products have received the most of major certification organizations across the world, including UL for United States, TUV for Europe, CQC for China, China Compulsory Certification, ISO9001, ISO14001...



Business Layout



ASP's business landscape extends to all five continents. Clients from 45 countries and regions have received services from ASP in past 15 years.

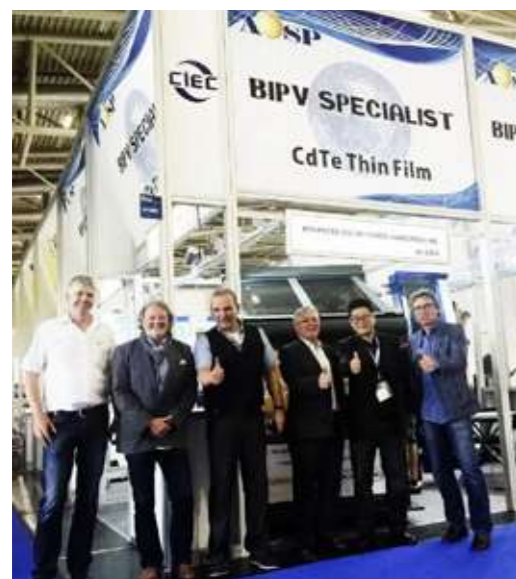
Global Market Exposure



On October 29, 2021, Advanced Soltech, a joint venture of Longyan, was officially listed on the NASDAQ (Nordic) Exchange.



ASP's PV Tiles at SNEC show

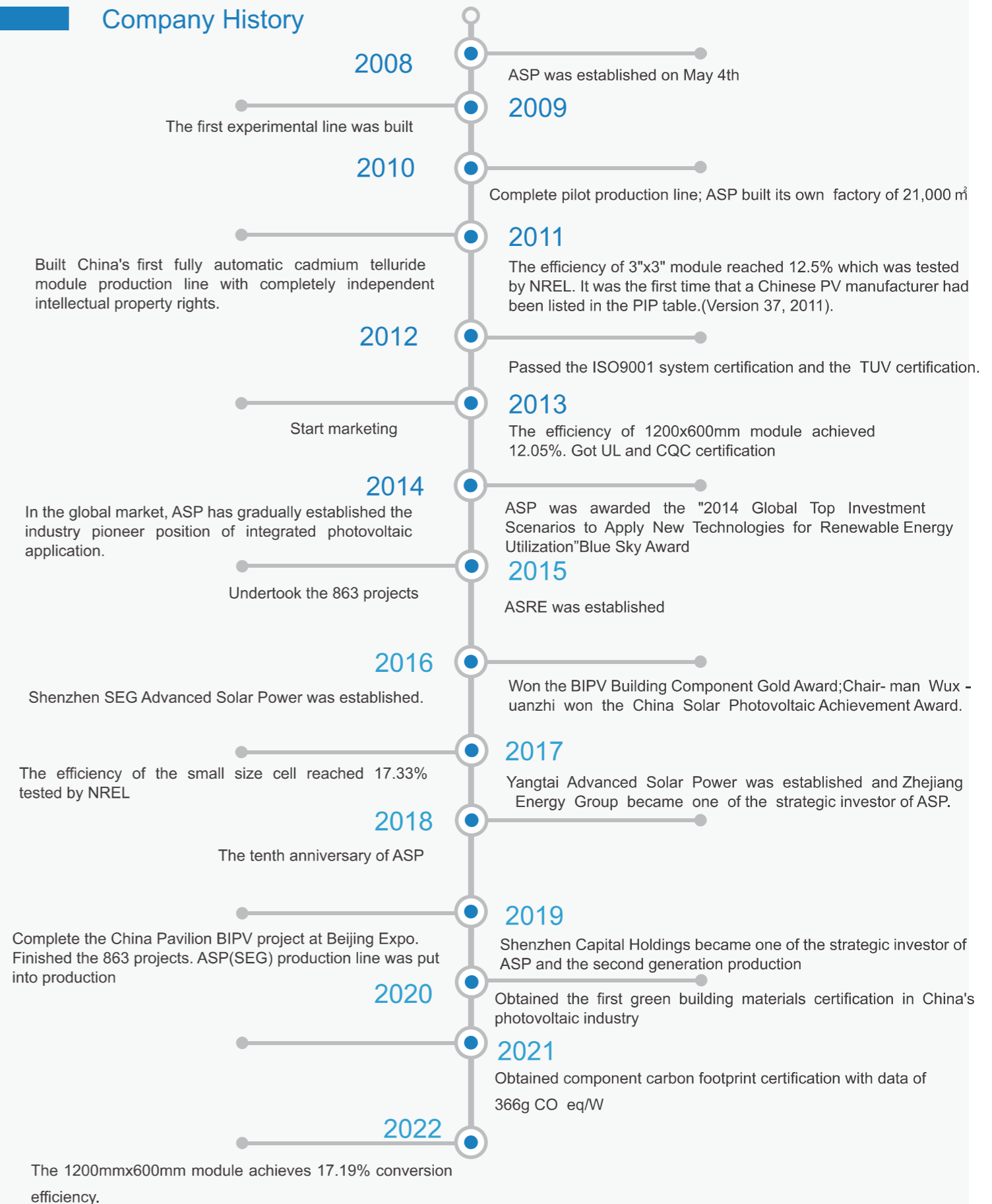


InterSolar Eu in Munich



The former Prime Minister of Egypt visited ASP's booth in Cairo.

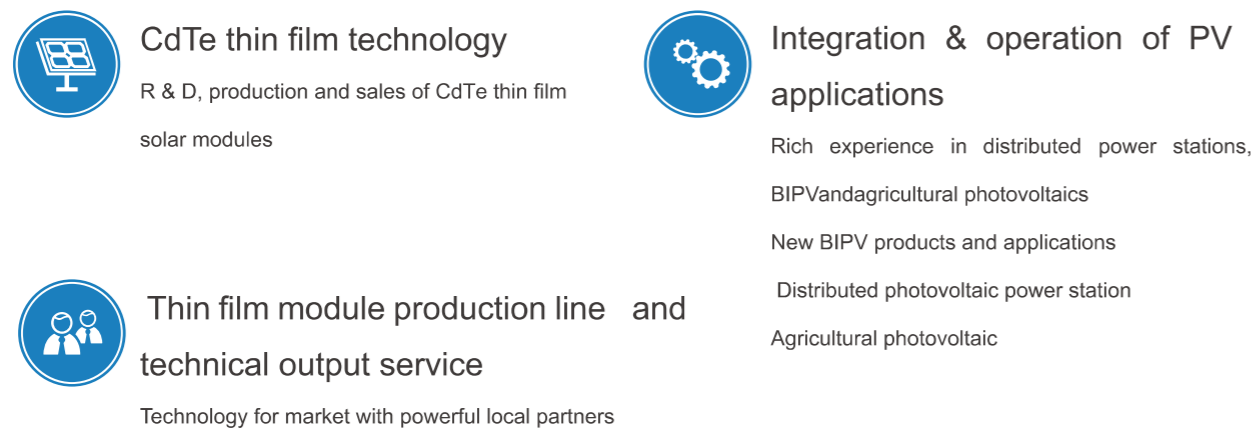
Company History



Founding Team



Business Solutions



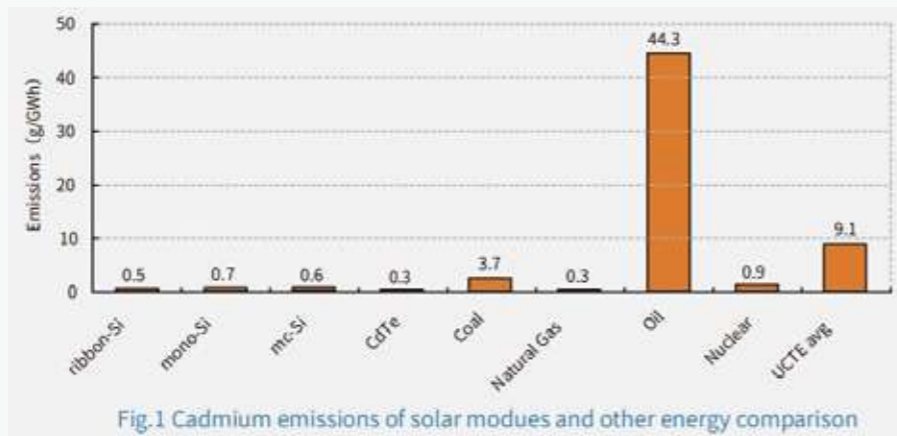
Joint Ventures



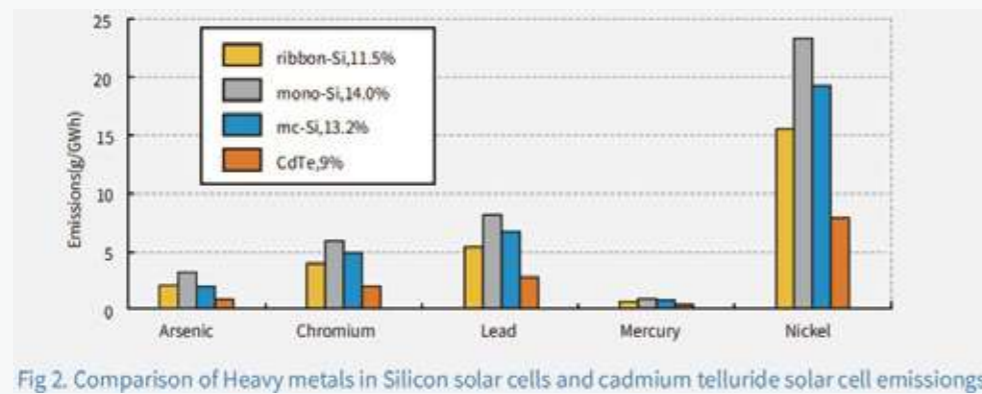
03 Product Description

Safety and Environment - Friendly

Scientists in Brookhaven national laboratory US systematically studied the heavy metal emissions from renewable energy, such as crystalline silicon solar cell, CdTe thin film solar cell, and traditional energy, such as coal, oil, natural gas and nuclear energy. In the analysis of solar cell, the full life-cycle process was considered including the original processing of ores required for the solar cell materials, the production and use of solar cells, etc.. The study results show that the highest cadmium emission is oil which achieves 44.3g/GWh, the second highest is coal about 3.7g/GWh. The cadmium emission of CdTe thin film solar module is only 0.3g/GWh as same as natural gas.



Based on extensive experimental data proving that CdTe solar product is environment-friendly, the EU exempted CdTe modules for RoHs requirements in 2011. By developing a recycling technology, ASP is able to recycle used CdTe modules.

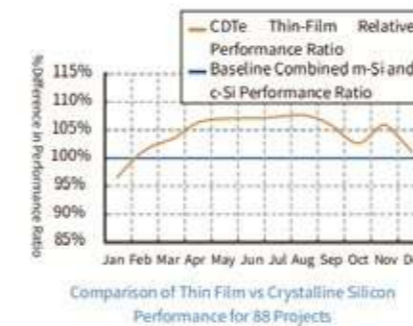


In the summary, with the lowest cost of power generation, the ASP CdTe thin film solar module can help the world to achieve the revolution of clean energy and harvests of both economic and environmental benefits.

EXCELLENT POWER GENERATION PERFORMANCE

ASP series CdTe thin film modules have a high efficiency and a proven excellent record on power generation performance.

Comparing to crystalline silicon solar module, CdTe thin film module generates 5.4% more in average of electricity every year in Europe. (PHOTON'S 2nd Thin Film Conference)

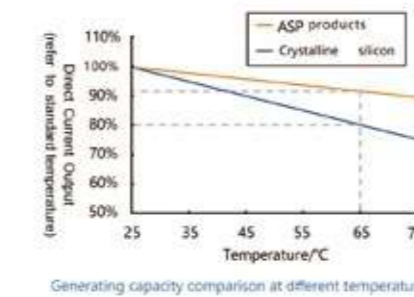


HIGH CONVERSION EFFICIENCY

Cadmium Telluride is a semiconductor compound with a high absorption coefficient-100 times higher than silicon. The band gap width of cadmium telluride is more suitable for photovoltaic energy conversion than silicon. To absorb the same amount of light, the thickness of cadmium telluride film is only one hundredth that of silicon wafer. Today, the world record of cadmium telluride thin film conversion efficiency has reached 22.1% in the laboratory. And the CdTe thin film solar module produced by Advanced Solar Power (Hangzhou) Inc reaches to 14% and above on conversion efficiency. The ASP series products have obtained TUV, UL and CQC certifications.

LOW TEMPERATURE COEFFICIENT

The temperature coefficient of ASP CdTe thin film solar module is only about -0.21%/°C, as the traditional silicon solar module temperature coefficient reaches to -0.48%/°C. For most of high solar irradiance regions on earth, the temperature of solar module at working can reach to 50°C or above. Thus this fact has greater



EXCELLENT LOW-IRRADIANCE EFFECT

Cadmium telluride is a direct-band gap material with high absorption for the full spectrum. Under low light condition, in dawn, dusk of a day or in a diffuse lighting, the power generation performance of CdTe thin film solar module has been proven to be higher than that of crystalline silicon solar module which is made by an indirect band gap material.

GOOD STABILITY

No intrinsic light-induced degradation effects.

LOW HOT SPOT EFFECT

The elongated cells of CdTe thin film module help to reduce the hot spot effect of module, which leads to a great advantage of improving the power generation capacity, ensuring the safety in usage and product life.

MINIMAL BREAKAGE RATE

Contributed by a proprietary technology adapted in ASP's CdTe modules manufacturing process, ASP's CdTe module has a minimal breakage rate.

EXCELLENT APPEARANCE

CdTe modules have uniformity color - pure black which provides an excellent appearance, fit best in buildings that have higher standards on appearance, unity and energy-independence.

Low carbon footprint

The carbon footprint of ASP's cadmium telluride thin-film photovoltaic modules is only 366g CO₂ eq/W. This is currently the lowest carbon footprint data certified by third-party organizations for photovoltaic modules in China.

CdTe Thin Film Solar Technology



Green Building Materials Certification No. 001

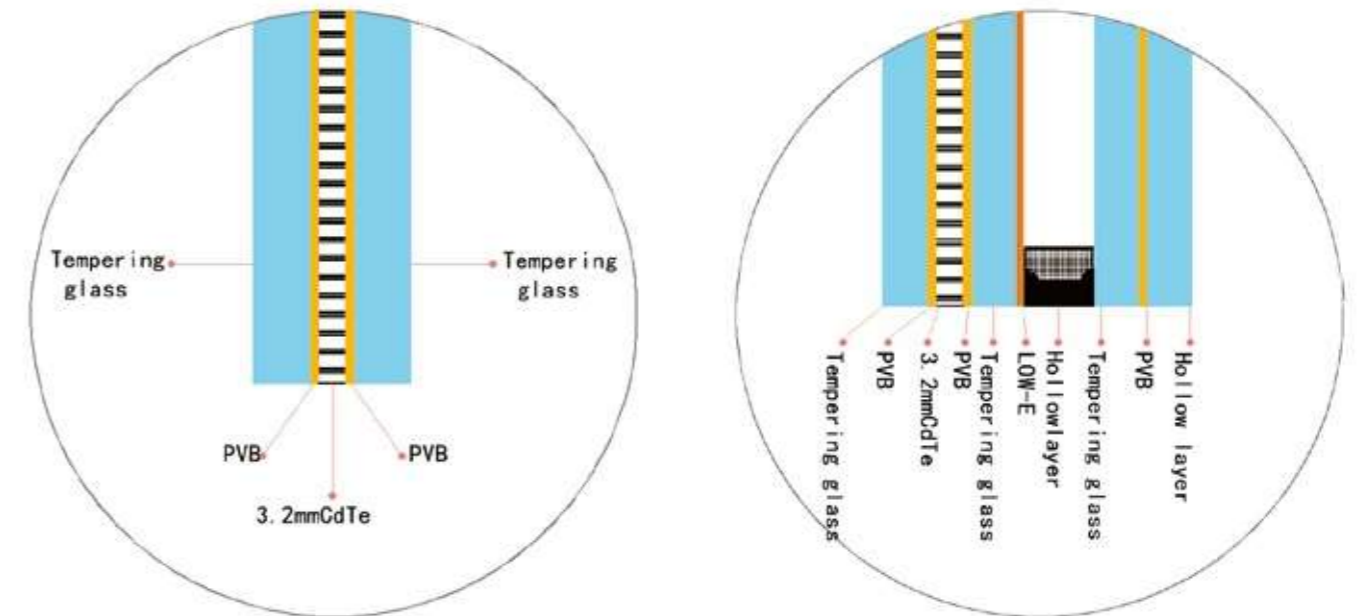
The first green building material certification in the photovoltaic industry



Product Carbon Footprint Certificate

Product carbon footprint: 0.366kg/W

Structural Diagram of ASP BIPV Product



You can customize **colors** You can customize **pattern** You can customize **size**

You can customize **shape** You can customize **structure**

You can customize **transparency**

CdTe Thin Film Solar Technology

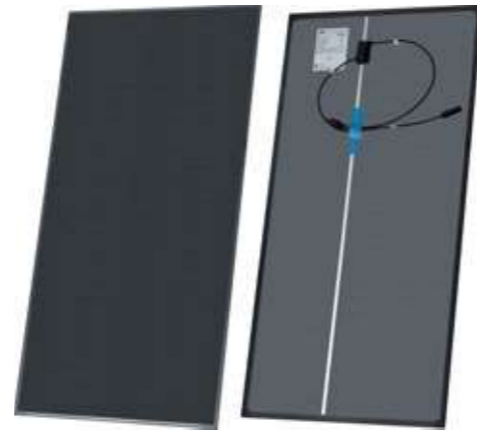
ASP has fully acquired the ability to scale up the industrialization of its proprietary cadmium telluride thin-film solar technology, which has complete independent intellectual property rights.

ASP's building-integrated photovoltaic glass can be widely applied to building walls, curtain walls, roofs, and even to roads and water surfaces.

While satisfying the safety, reliability, and aesthetic requirements of buildings, it can also provide green and clean photovoltaic power, enabling buildings to transform from pure energy consumers into energy producers.

Product Features

- 1 Strong power generation capacity
- 2 Small hot spot effect
- 3 High conversion efficiency
- 4 Minimal damage rate
- 5 Low temperature coefficient
- 6 Good weak light effect
- 7 Good safety performance
- 8 Low carbon footprint
- 9 Uniform color and elegant appearance



STANDARD THIN FILM MODULE



BIPV MODULE



PV Tile ASP - PV-TILE



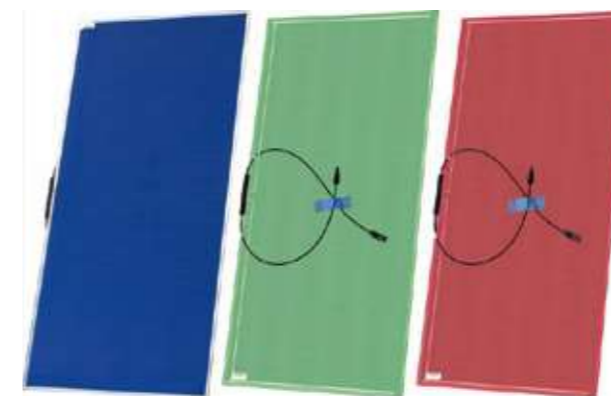
Imitation Aluminum Module



Photovoltaic floor tile Module



Imitation Red Brick and Imitation Wood Grain Module



Colored Semi-Transparent Module



Customizable patterns and colors Module

The versatility of the product

Photovoltaic hollow adhesive
Transparent, insulated, and insulated

Color photovoltaic building materials
Can be customized with personalized colors

Pattern photovoltaic building materials
Rich and colorful patterns and logos

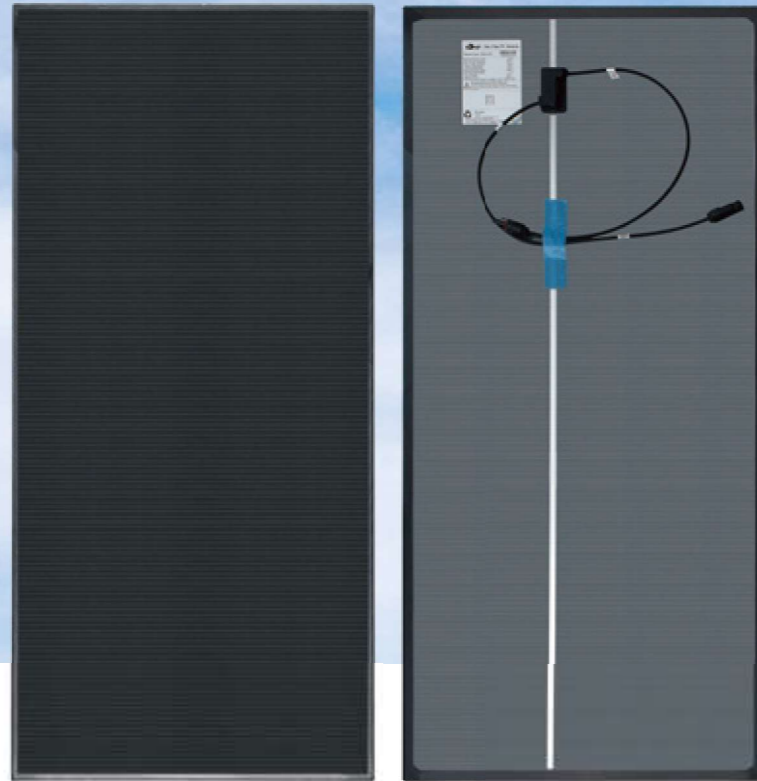
Photovoltaic photothermal integration
Having both power generation and hot water

Photovoltaic insulation building materials
Integration of photovoltaic and insulation materials

Multifunctional photovoltaic power
Replacing traditional tiles, beautiful and elegant

Specifications

① STANDARD THIN FILM MODULE



Application real scene of standard thin film component project



Standard Thin Film Module ASP -S1/S4						
Model	ASP-S1-100	ASP-S1-105	ASP-S1-110	ASP-S1-115	ASP-S1-120	ASP-S4-85
Nominal (Pm)	100W	105W	110W	115W	120W	85W
Open Circuit Voltage (Voc)	123.5V	124.0V	176.84V	180.49V	181.00V	29.2V
Short Circuit (Isc)	1.24A	1.28A	0.90A	0.918A	0.98A	4.19A
Voltage at Max. Power (Vm)	91.7V	92.9V	138.0V	138.18V	138.62V	23V
Current at Max. Power (Im)	1.09A	1.13A	0.80A	0.834A	0.87A	3.71A
Module Dimension	L1200*W600*D6.8mm					
Weight	12kg					
Power Temperature coefficient	-0.214%/°C					
Voltage Temperature coefficient	-0.321%/°C					
Current Temperature coefficient	0.060%/°C					
Material and Workmanship	10 years of product craftsmanship and material warranty; 25 year output power warranty					
Test Conditions	STC : 1000W/m ² , AM1.5, 25°C					
The product has obtained 1500V system certification						

Product features:

ASP's standard CdTe PV modules have a strong power generation capacity. Based on China's average lighting conditions, the annual power generation of one square meter of CdTe thin-film PV module is about 200kwh.

ASP's standard CdTe PV products are mainly applied to rooftop BIPV power stations, commercial and industrial rooftop PV power stations, household PV power stations, and photovoltaic sunrooms.

Standard CdTe PV products are uniformly black in color. Through clever design by architects, they not only match the appearance of the building harmoniously, but also have excellent power generation capabilities. It's a double benefit.

Compared with customized CdTe PV building materials, the standard series products have obvious price advantages, strong power generation capacity, and high cost performance.

Specifications

② Semi-transparent Thin Film Solar Module



Semi-transparent Thin Film Solar Module

Product size

L1200*W600mm ∙ L1200*W1200mm ∙
 L1200*W1800mm ∙ L1200*W2400mm ∙
 L1200*W3000mm ∙ L1200*W3600mm ∙
 ...

Adjustable transparency

10% transparency ∙ 20% transparency ∙
 30% transparency ∙ 40% transparency ∙
 50% transparency ∙ 60% transparency ∙
 70% transparency ∙ 80% transparency ...



Product Composition

TP5+3.2CdTe+TP5 TP6+3.2CdTe+TP6 TP8+3.2CdTe+TP8 ...
 TP5+3.2CdTe+TP5+12A+TP5 TP8+3.2CdTe+TP8+12A+TP8 ...
 TP5+3.2CdTe+TP5+12A+TP5+TP5 TP8+3.2CdTe+TP8+12A+TP8+TP8 ...

Power generation

72W ∙ 164W
 248W ∙ 288W
 360W ∙ 432W
 ...

Product weight

33.3kg/m²
 40.3kg/m²
 60.3kg/m²
 ...

Specifications

⑥ Imitation Aluminum Module



Aluminum series



Stone series



Marble series



Red brick series



Wood grain series

Imitation Building Materials Product Series

Product size : L1200*W600*D16mm ...

Product structure: : TP5+3.2CdTe+TP5·TP6+3.2CdTe+TP6

TP8+3.2CdTe+TP8 ...

Power generation: 43W·47W·66W ...

Product weight : 25.5kg·50 kg ...

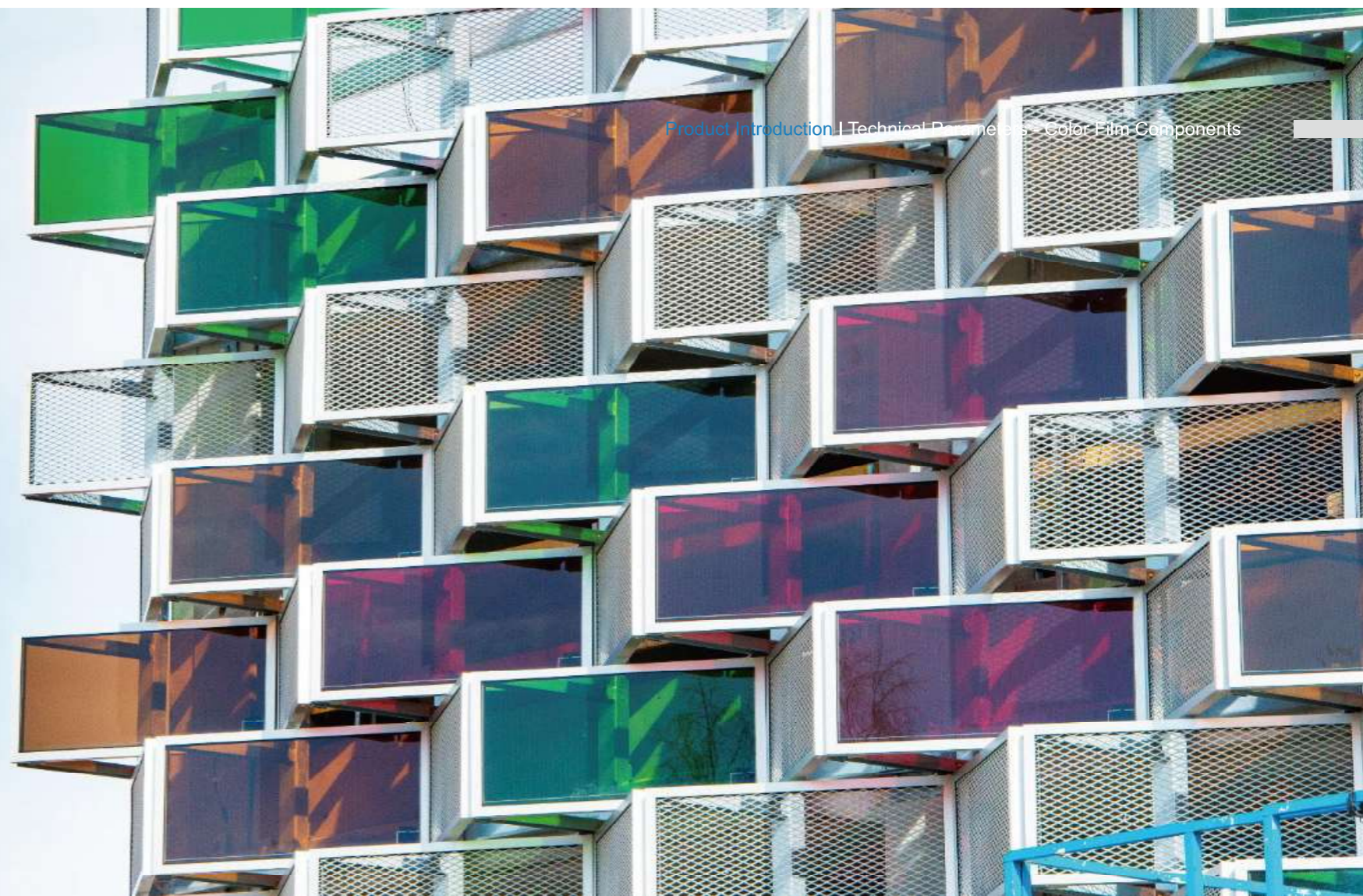
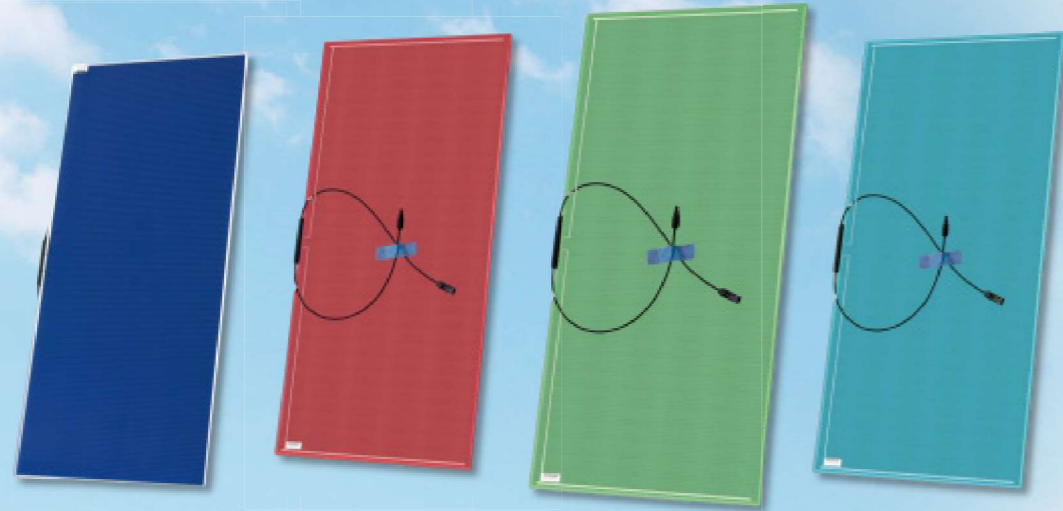
Product pattern : Customize color patterns according to project requirements

According to industry data analysis, non-transparent exterior walls account for up to 70% in the building envelope, while transparent glass doors and windows account for about 20%. ASP's CdTe PV building materials can replace traditional building materials and have tremendous market application prospects in non-translucent areas of buildings.



Specifications

7 Colored Semi-Transparent Module



Colored Semi-Transparent Module

Product size : L1200*W600*D7mm /L1200*W1200*D16mm ...

Product mix : TP5+3.2CdTe+TP5 /TP6+3.2CdTe+TP6

TP5+3.2CdTe+TP5+12A+TP5+TP5 ...

Power generation: 57W /76W /85W ...

Product weight : 12.0kg /50.5kg ...

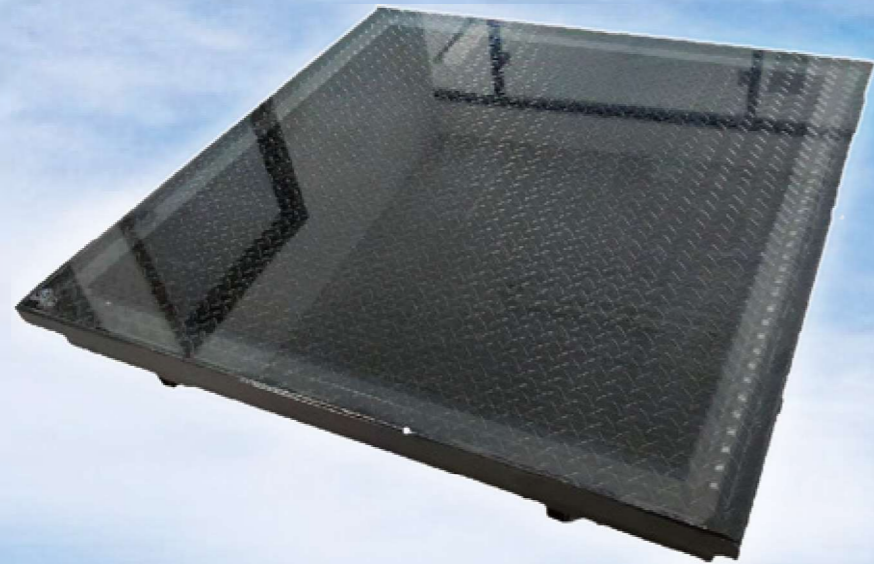
Product pattern : Customize color patterns according to project requirements

Transmittance : 10% /20% /30% /40% /50% ...



Specifications

⑧ Photovoltaic floor tiles



Photovoltaic floor tile series products

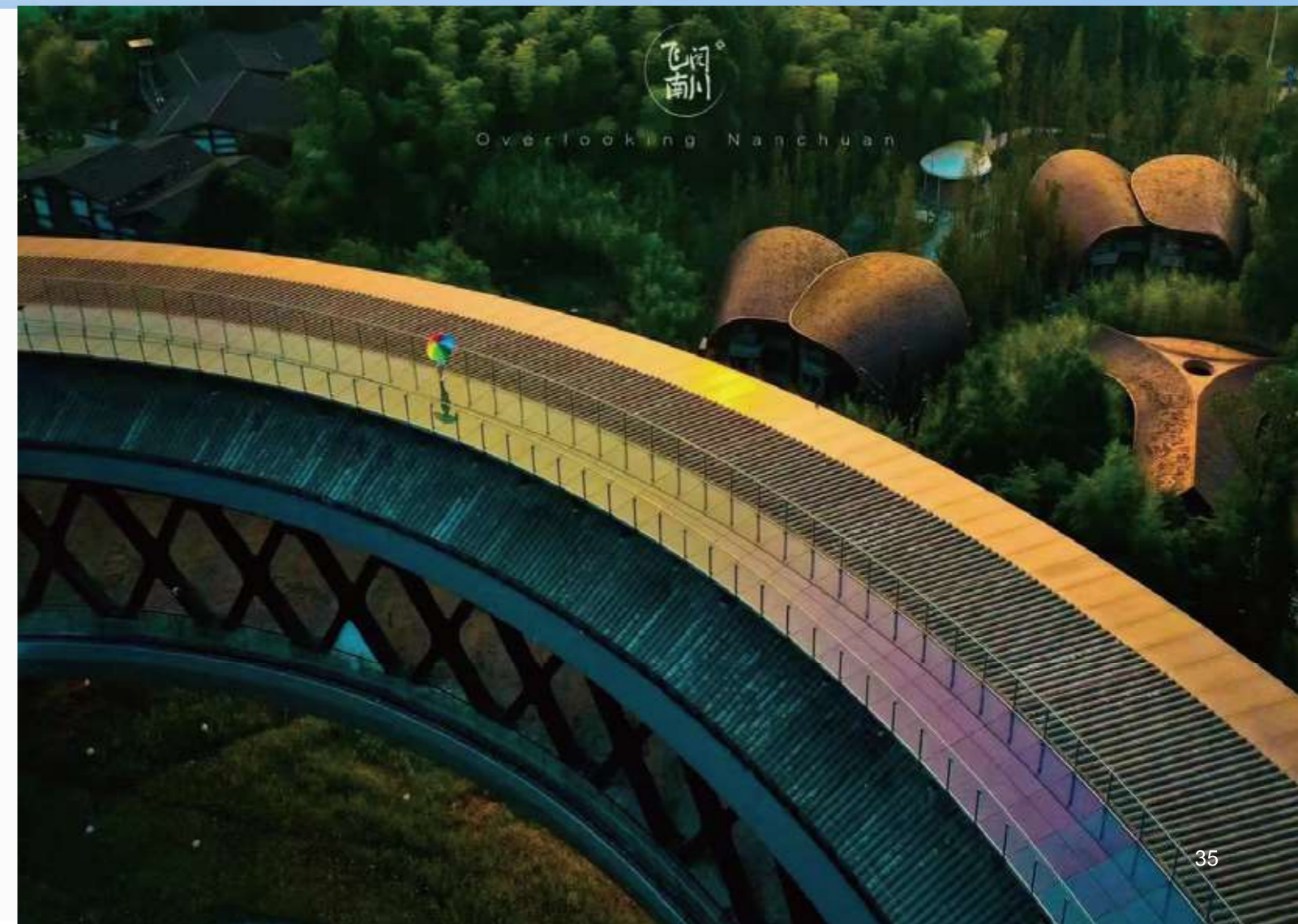
Product size : L600*W600*D52mm

Product mix : TP8+3.2mmCdTe+TP8

Power generation: 46W

Product weight : 21kg

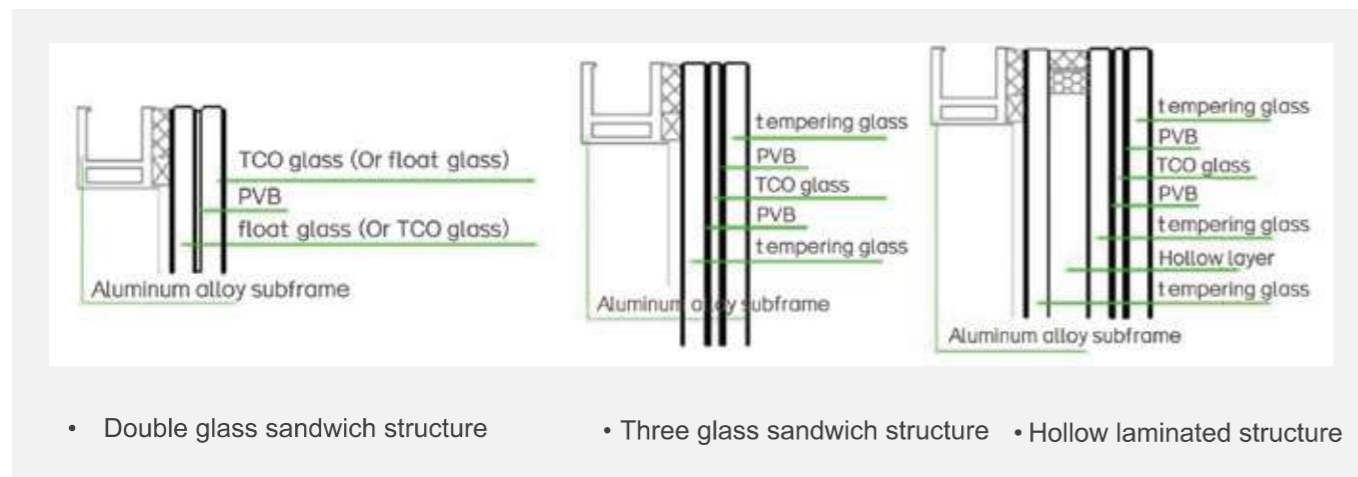
Other Description : LED light strips, energy storage batteries, and controllers
can be selected according to project requirements



04 BIPV Solution

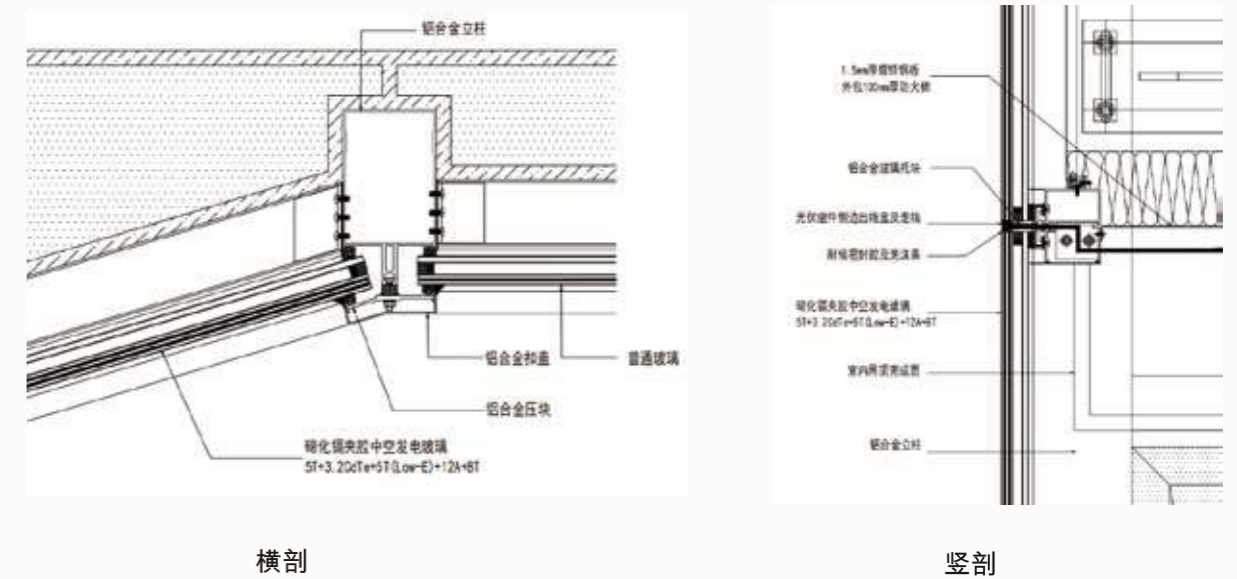


Typical structural categories of thin film photovoltaic curtain wall glass



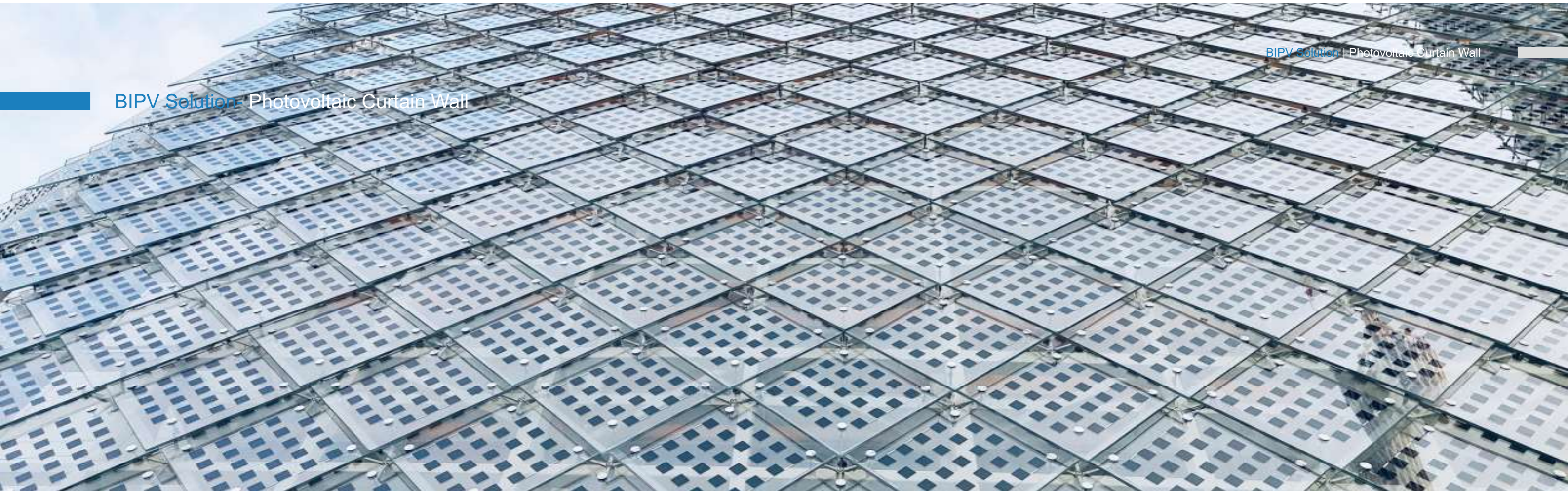
The photovoltaic glass curtain wall components adopt double glass laminated adhesive, three glass laminated adhesive, etc. according to the requirements of usage function, installation height, etc. Single hollow sandwich (low e) and double hollow sandwich (low e) structures, with glass thickness meeting the requirements of building curtain walls.

Example of Standard System for Vertical and Horizontal Hidden Photovoltaic Curtain Walls

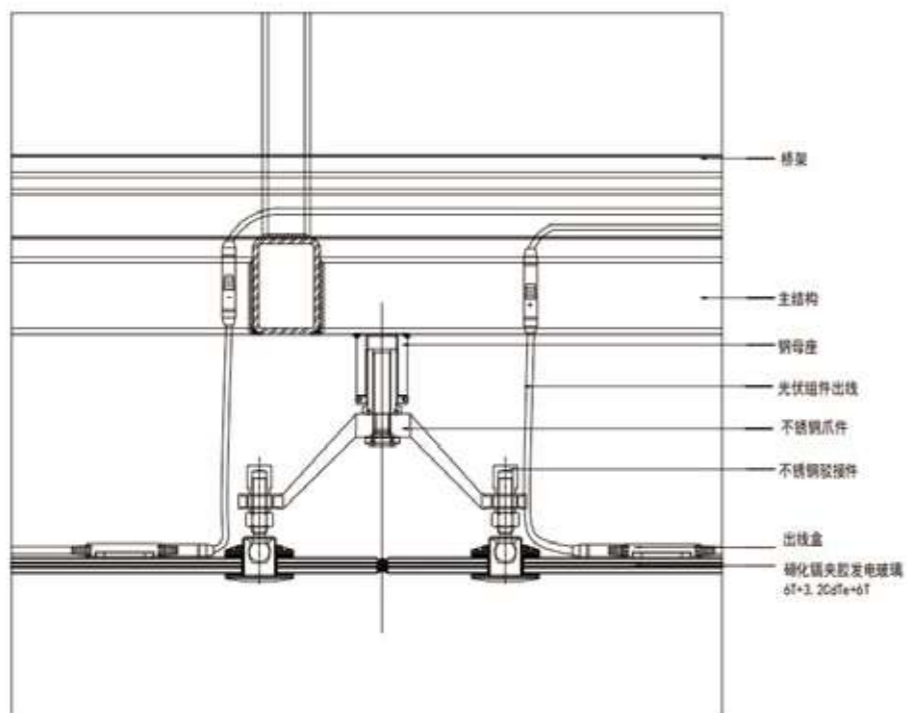


Photovoltaic curtain walls are classified by structure, mainly including open frame, point supported, hidden frame, semi hidden frame, etc

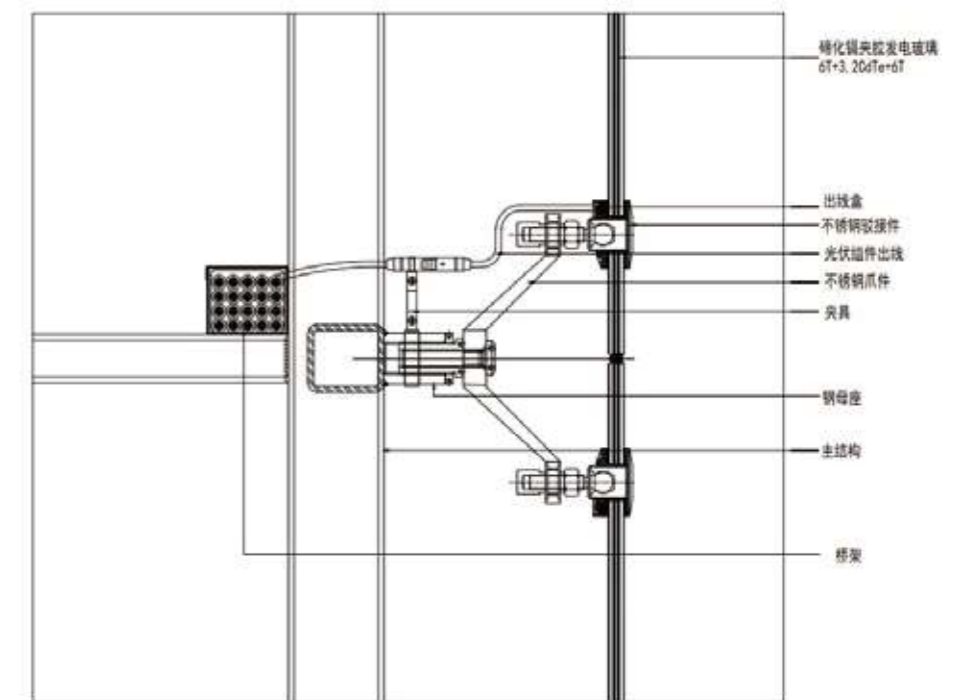
BIPV Solution - Photovoltaic Curtain Wall



Example of a standard system for point supported photovoltaic curtain walls



Transverse section



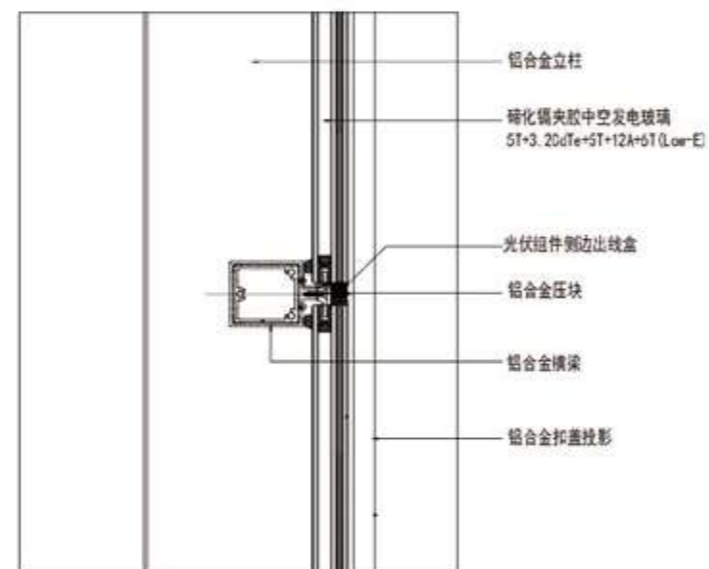
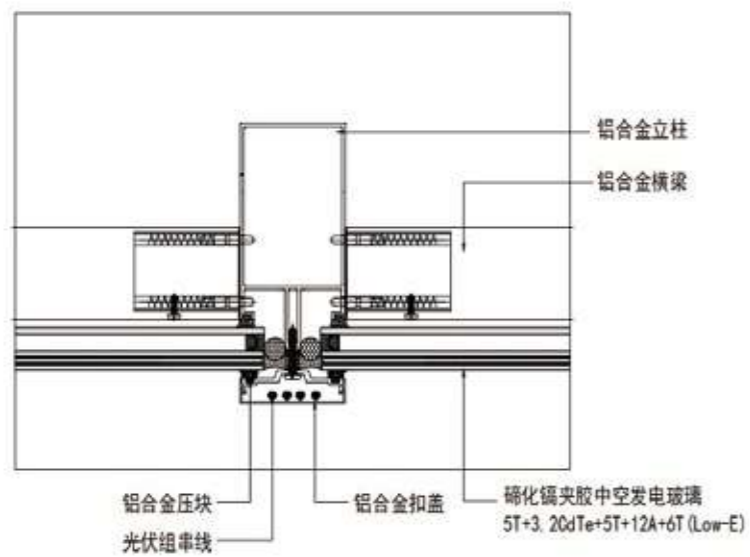
Vertical section

BIPV Solution - Photovoltaic Curtain Wall



Construction Drawing of Photovoltaic Curtain Wall Project Site

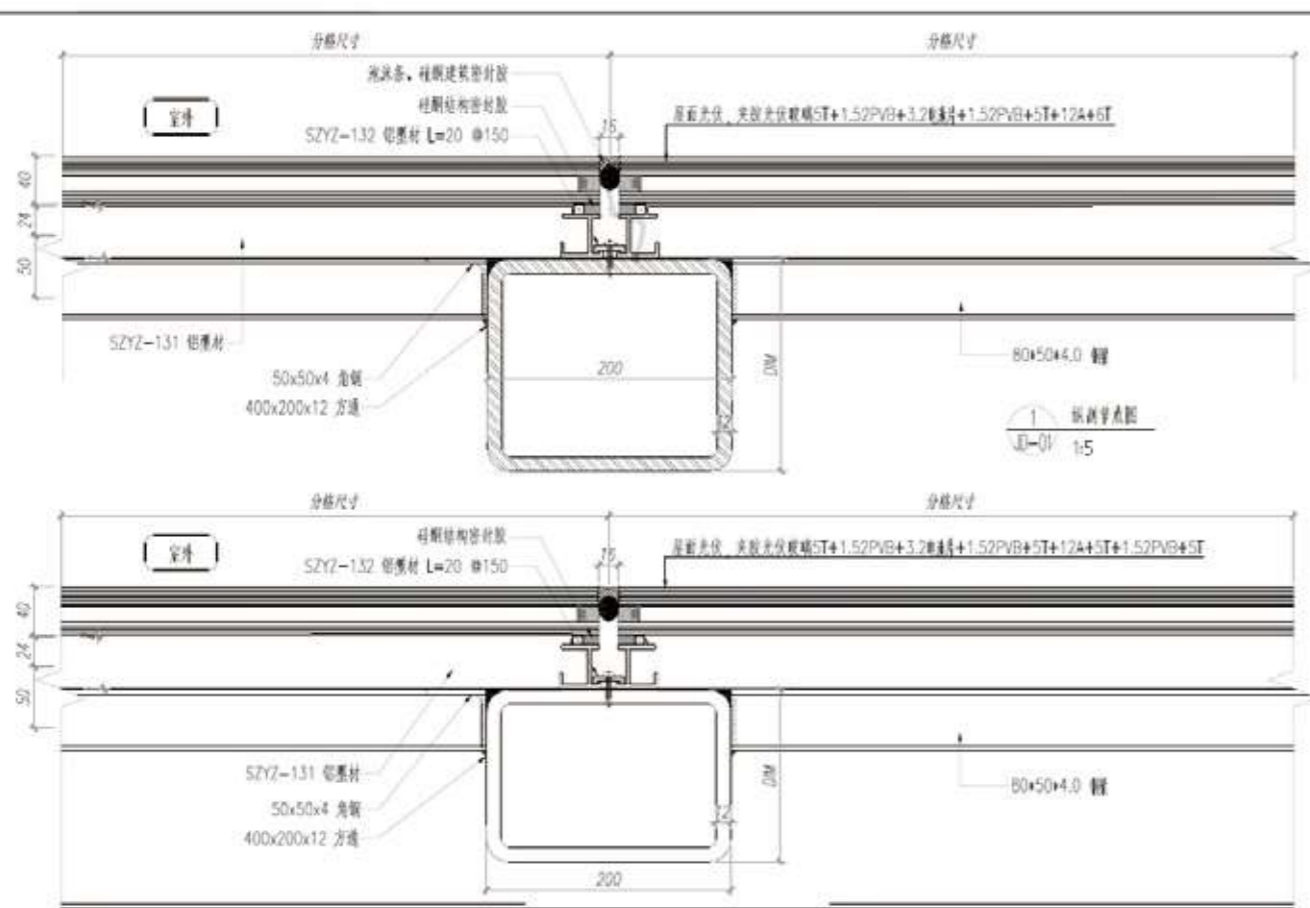
Example of Standard System for Hidden Frame Photovoltaic Curtain Wall



BIPV Solution - Photovoltaic daylighting roof

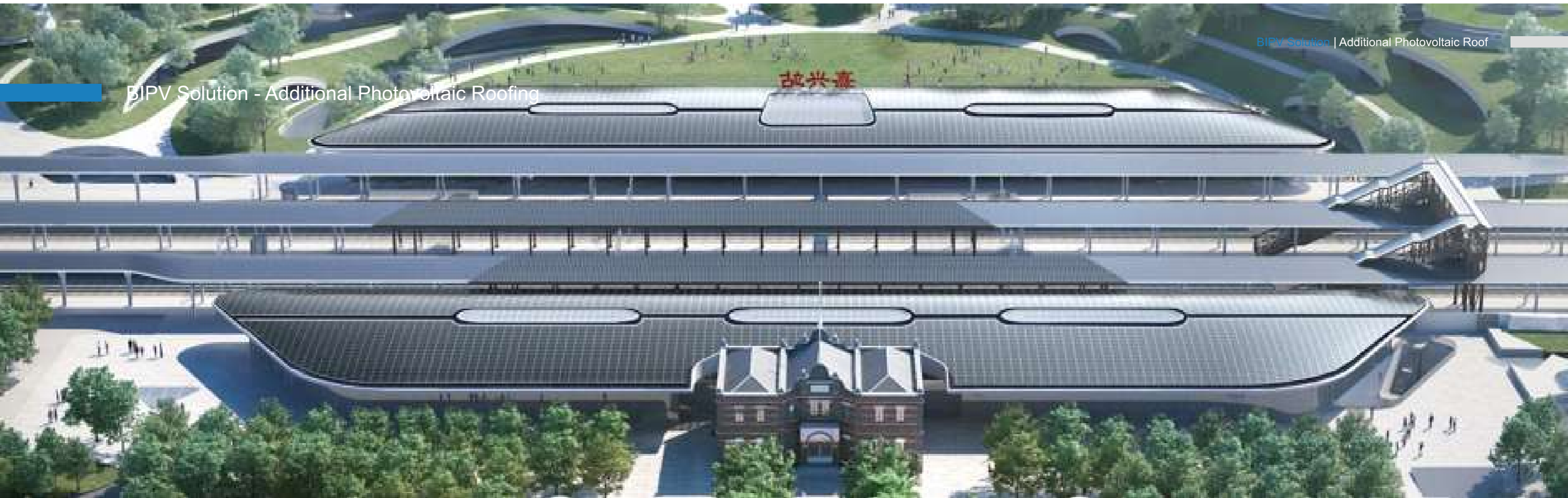


Installation node diagram of photovoltaic daylighting roof

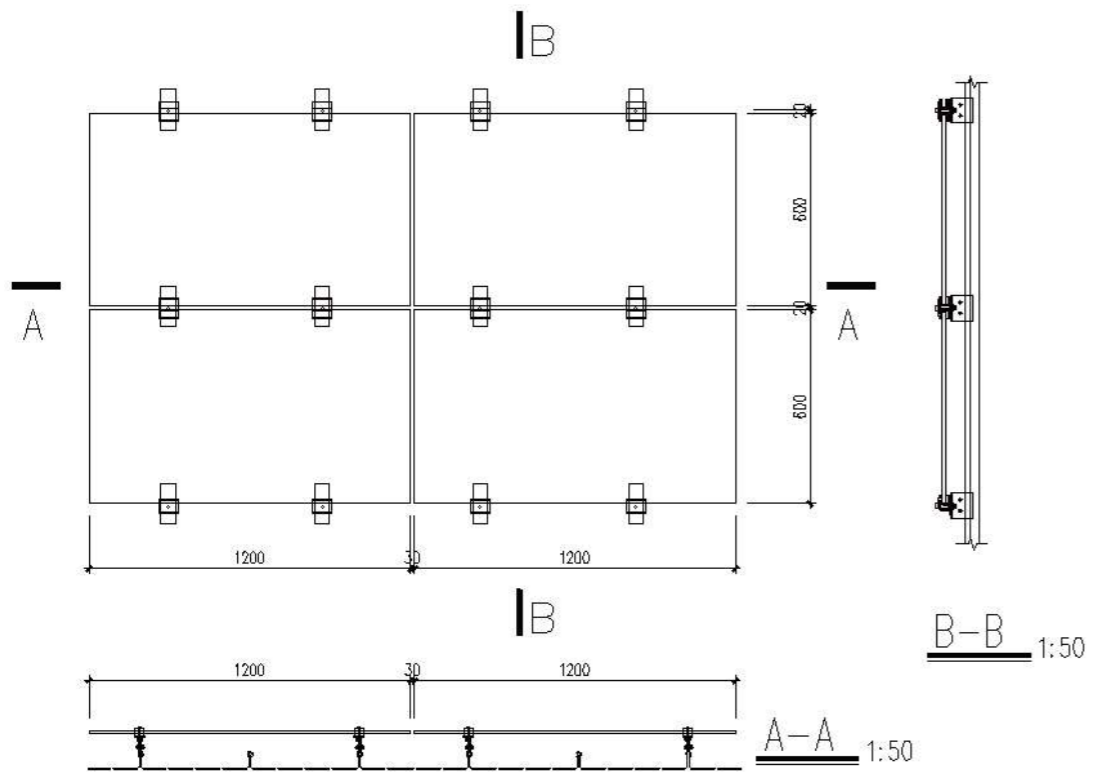


- Installation using curtain wall concealed frame method
- The photovoltaic module is fixed by structural adhesive with the attached frame
- Install the components onto the original skeleton and fix them with pressure blocks and self tapping screws
- Adjacent photovoltaic modules are sealed with silicone adhesive
- Photovoltaic cables can be hidden inside the enclosure

BIPV Solution - Additional Photovoltaic Roofing



Additional photovoltaic roof installation nodes



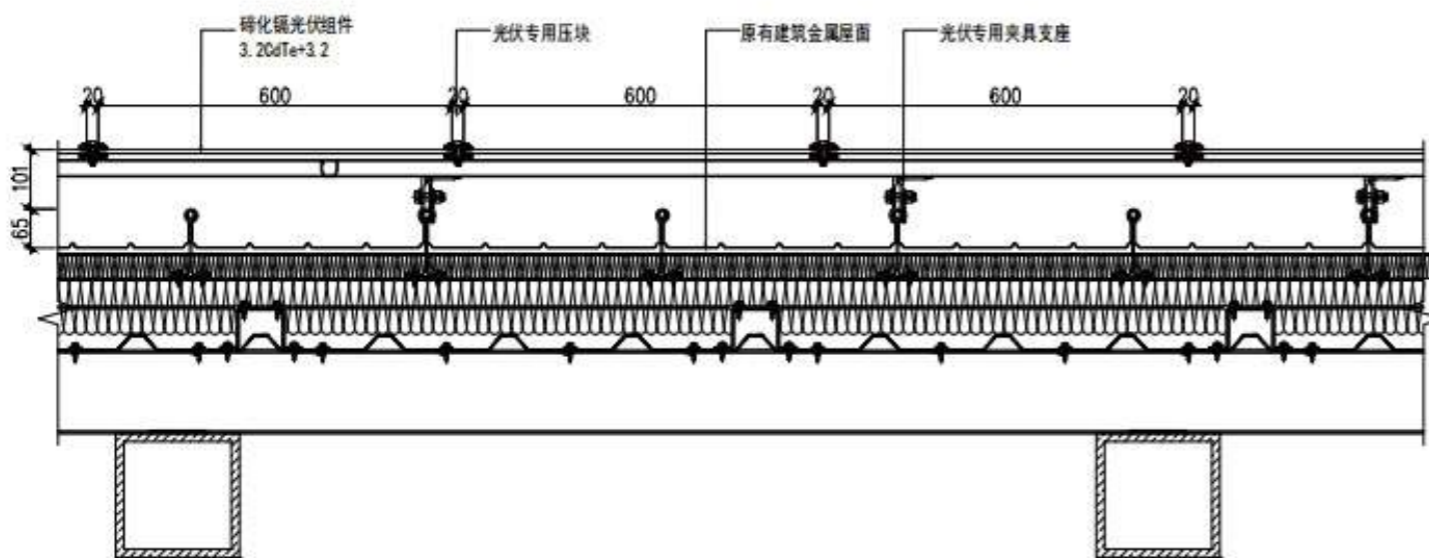
The installation of point support structure perfectly solves the installation restriction of hyperboloid roof to flat glass, and can meet the slope requirements of various positions.



BIPV Solution - Additional Photovoltaic Roofing



Additional photovoltaic roof installation nodes



Photovoltaic dedicated point support fixture



BIPV Solution - Photovoltaic tiles



Node diagram of photovoltaic tile roof installation

