



Sunman: Lightweight Solar Applications in the C&I Rooftop Market

2024 Corporate Presentation V1.0

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01 Company



Sunman at a glance

- Founded in 2014, Sunman is an Australian Solar Technology Company
- Commercialized world's first ultra-light, glass-free crystalline silicon PV module "eArc"
- 600 MW+ shipments delivered to 40+ countries (Q4 2023)
- Operates 1 GW production capacity out of Jiangsu Province, China

Founder

- Sunman's founder is PV scientist and industry pioneer
Dr. Zhengrong Shi
- Founder of Suntech Power (No.1 PV Manufacturer
2010-2011)
- Founder of Asia Silicon (5th Largest Polysilicon producer)
- Central Figure to the development of global PV Industry
- Owner of 80 patents and author of 110 Academic
Papers
- Professor at the University of New South Wales
- Fellow at Australian Academy of Technological Sciences
& Engineering



Development History



Founded by a group of industry veterans

2014.10



Sunman launches its first 12 MW production line

2016.07



Products pass CSA certification

2017.05



Capacity expands to 100 MW

2019.05



Sunman closes Series B Financing

2020.11



Sunman launches the World's First GW-Scale Lightweight PV Module Manufacturing Base

2022.1



Sunman closes Series D Financing

2023.12

2016.02

Products pass IEC Certification



2016.12

Products pass JET certification



2018.01

Sunman closes Series A Financing



2019.09

Products pass new IEC Certification



2021

Continued R&D, growth and capacity expansion

2022.6

Sunman closes Series C Financing



2023

Cumulative shipments of eArc modules reach 600 MW

Backed By Blue-Chip, Global Investors



Sunman is backed by leading PE firms and VCs.
Largest Shareholder is the **Clean Energy Finance Corporation**
Australian Government Backed “World’s Largest Green Bank”

Sunman has successfully commercialized eArc modules to 1 GW capacity

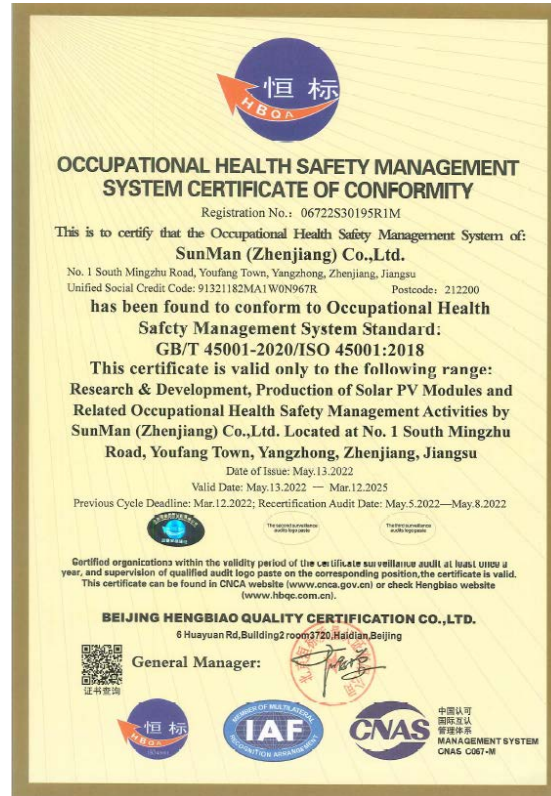


World class standards



ISO9001

Quality Management System



ISO45001

Occupational Health Safety Management System



ISO14001

Environment Management System

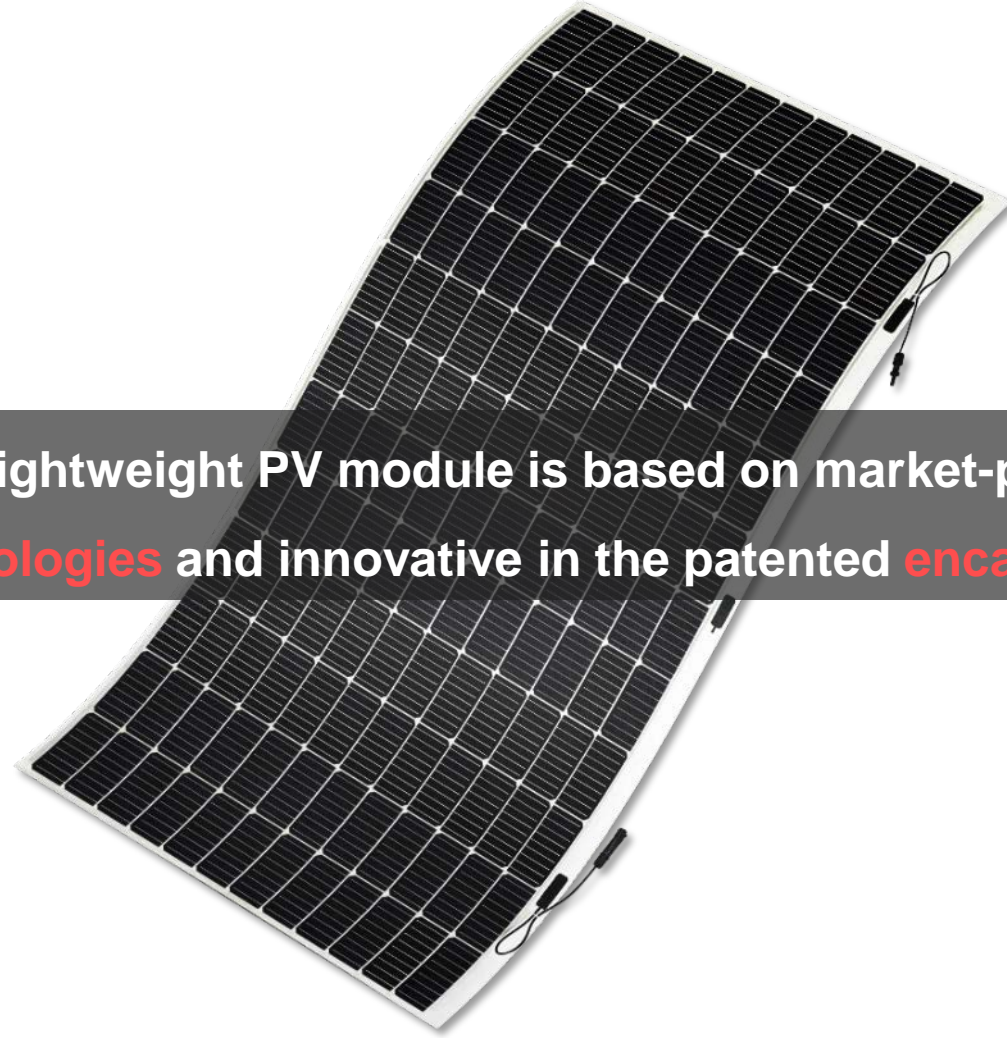


SA8000

Social Accountability 8000 International Standard

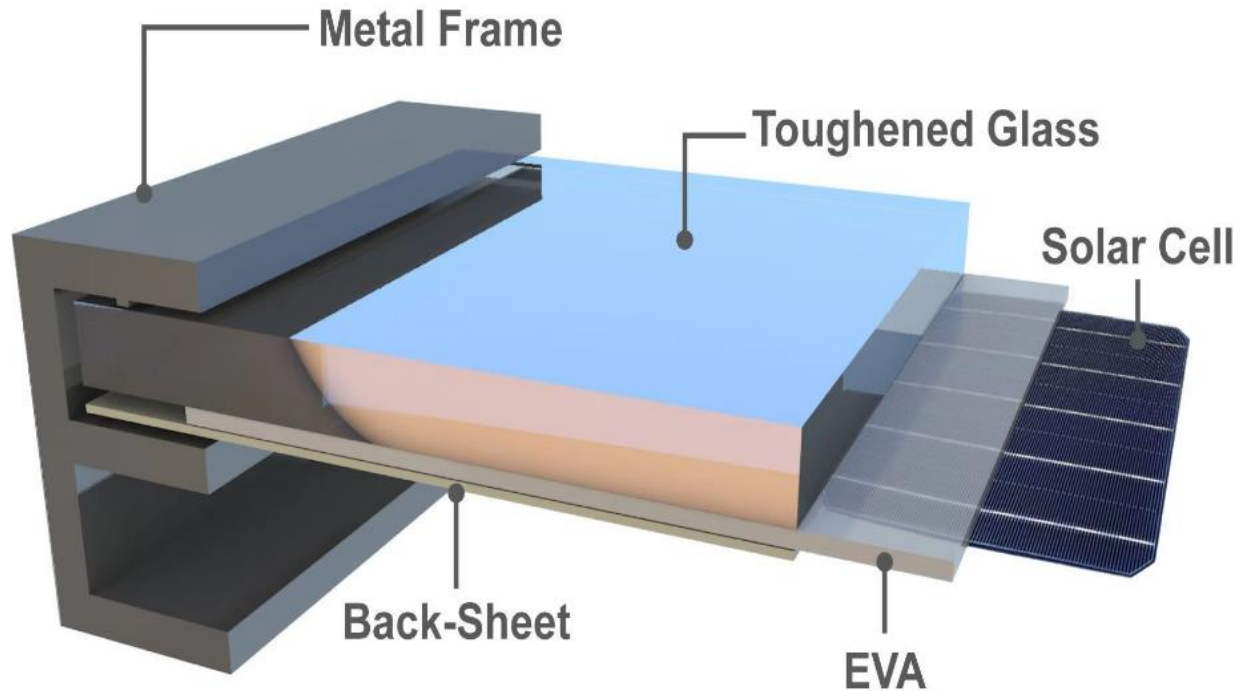
02 Technology

eArc Technology



Sunman's eArc lightweight PV module is based on market-proven **crystalline silicon cell technologies** and innovative in the patented **encapsulation system**.

Addressing The “Weight” Issue



Module weight= 20 kg

Cell weight= 0.72 kg

Only 3.6% generate electricity

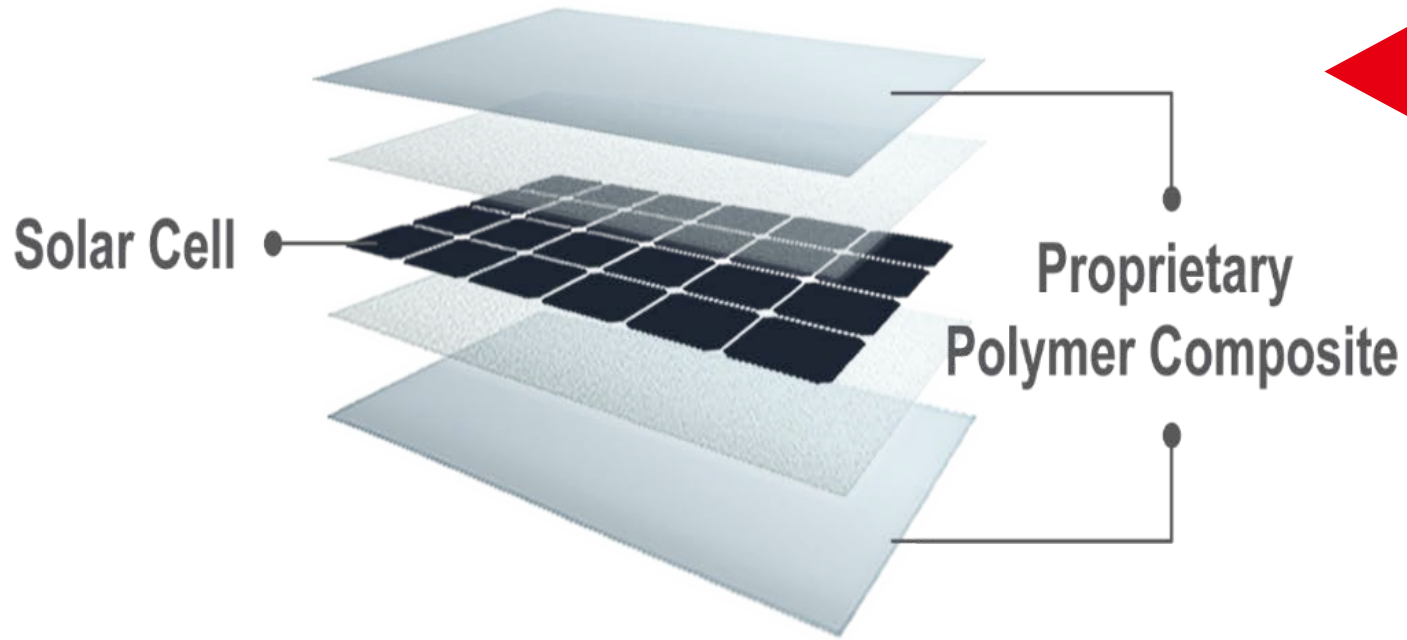
Module thickness= 40 mm

Cell thickness= 0.17 mm

Only 0.43% generate electricity

- The structure of conventional glass modules have remained unchanged in the last 50 years.
- An estimated 40% C&I rooftops cannot install solar due to static load issues.

Sunman's Innovation "eArc"



Module weight= 5.8 kg

Cell weight= 0.72 kg

12% generates electricity

Module thickness= 2 mm

Cell thickness= 0.17 mm

8.5% generates electricity

- eArc module uses patented polymer composites to replace glass and reduce weight.
- eArc is 70% lighter than traditional glass counterparts.

Complete Certifications for Global Deployment

認 証 書
Certificate

IEC PVm 認 証 業 務 規 程 第 7 項 の 規 定 に よ り、認 証 登 録 の 要 件 に 適 合 し て い る も の と 認 め ら れ ま す の で 認 証 し ま す。
I hereby certify that the product mentioned below complies with the Requirements for the Registration of Certification in the Rules for Operation of PVm Certification, Section 7.

認 証 書 番 号 : PV190-53201-1002
Certificate Number:
認 証 登 録 日 : 平 成 29 年 9 月 4 日
Date of Issue: September 4, 2017
有 効 期 限 : 平 成 34 年 9 月 3 日
Date of Validity: September 3, 2022

認 証 取 得 者 : SUNMAN (HONG KONG) LIMITED
Room 1401, 14/F, World Commerce Centre, Harbour City,
7-11 CANTON ROAD, TSIMSHATSUI, KOWLOON, HONG KONG,
P. R. CHINA
Certificate Recipient:

認 証 製 品 製 造 工 場 : PV190-3
ZHENJIANG FENGYUAN NEW ENERGY TECHNOLOGY CO., LTD.
NO. 1, MINGZHU SOUTH ROAD, YUFANG TOWN, ZHENJIANG,
JIANGSU, 212218, CHINA
Factory of Certified Product:

試 験 基 準 : IEC61215 Second edition 2005-04,
IEC61730-1 First addition 2004-10,
IEC61730-2 First edition 2004-10
Applied Standard for Testing:

製 品 の 型 号 等 :
Type/Name of Product:
認 証 モ デ ル の 名 称 : 太 陽 電 池 モ ジ ュ ー ル (単 結 晶)
Name of Certified Model: PV module (single crystal)
認 証 モ デ ル の 型 名 : SMA310W-6X12 etc.
Type of Certified Model: As shown in the attachment for details
認 証 モ デ ル の 社 様 : 付 属 書 1 の と お り
Manufacturer of Certified Model:

一 般 財 団 法 人 電 気 安 全 環 境 研 究 所
Japan Electrical Safety & Environment Technology Laboratories
理 事 長 藤 田 康 久
President Yasuhisa Katsuda

東 京 都 港 区 代 々 木 5-14-12
5-14-12 Yayoi-Shibuya-Ku, Tokyo

VDE Prüf- und Zertifizierungsinstitut

**ZEICHENGENEHMIGUNG
MARKS APPROVAL**

Sunman (Hong Kong) Limited
Room 1401, 14/F., World Commerce Centre
Harbour City, 7-11 Canton Road,
TSIMSHATSUI
Kowloon
HONG KONG
Ist berechtigt, für ihr Produkt,
is authorized to use for their product

**Terrestrische Photovoltaik-Module mit Silizium-Solarzellen
Crystalline silicon terrestrial photovoltaic modules**

die hier abgebildeten markenrechtlich geschützten Zeichen
für die ab B 202 aufgeführten Typen zu benutzen
The legally protected Marks are shown below for the types referred to on page 2 if

Geprüft und zertifiziert nach /
Tested and certified according to

EN 61215 (VDE 0128-31) 2006-02, EN 6121 2006-01
EN 61733-1 (VDE 0128-31) 2007-10, EN 61733-2 2007-08
EN 61733-1-01 (VDE 0128-31) 2012-09, EN 61733-1-02 2012
EN 61733-1-02 (VDE 0128-31) 2012-09, EN 61733-1-02 2012-09
EN 61733-1-01 (VDE 0128-31) 2012-09, EN 61733-1-02 2012-09
IEC 61215 2006
IEC 61733-1 2006
IEC 61733-1-01 2012
IEC 61733-1-02 2012
IEC 61733-1-02 2012

Befreiung zum / vgl. Nr. 2019-06-30
VDE Prüf- und Zertifizierungsinstitut GmbH
VDE Testing and Certification Institute
Zertifizierungsstelle / Certification
Offenbach 2016-02-04
(letzte Änderung / updated: 2016-12-22)

Anzahlzeichen: 600246-3672-0001 / 250233
File No.
Ausweis-Nr.: 40043701 Blatt 1
Certificate No. Page
Zertifizierungsstelle und -Cooperation /
Certification Institute and Co-operation
Offenbach 2016-02-04
(letzte Änderung / updated: 2016-12-22)

VDE Zertifizierungsstelle / VDE Testing and Certification Institute
VDE-Zertifizierungsinstitut GmbH / VDE Testing and Certification Institute
http://www.vde.com/de/0128-31
http://www.vde.com/de/0128-31

VDE

CSA Group

Certificate of Compliance

Certificate: 70133275 Master Contract: 269671
Project: 70133275 Date Issued: 2017-05-04

Issued to: Sunman (Hong Kong) Limited
Room 1401, 14/F., World Commerce Centre, Harbour City,
7-11 Canton Road, Tsimshatsui, Kowloon, Hong Kong.
Attention: Ted Kong

The products listed below are eligible to bear the CSA Mark shown with adjacent indicators 'C' and 'US' for Canada and US (indicating that products have been manufactured to the requirements of both Canadian and US Standards) or with adjacent indicator 'US' for US only or without either indicator for Canada only.

Issued by: Qiang (Sean) Jiang
Qiang (Sean) Jiang

CSA
C US

PRODUCTS
CLASS - C531110 - POWER SUPPLIES-Photovoltaic Modules and Panels
CLASS - C531190 - POWER SUPPLIES-Photovoltaic Modules and Panels - Certified to US Standards
Photovoltaic Modules with maximum systems voltage of 600 V dc and Class C fire class rating (Canada),
Model Series SMDXXXX-6X12 (XXX = 275 to 340 step 5), SMDXXXX-6X10 (XXX = 230 to 280 step 5),
SMDXXXX-6X06 (XXX = 140 to 170 step 5), SMDXXXX-4X12 (XXX = 185 to 225 step 5), SMDXXXX-4X10 (XXX = 155 to 190 step 5), SMDXXXX-4X09 (XXX = 140 to 170 step 5), SMDXXXX-4X06 (XXX = 090 to 110 step 5), SMDXXXX-4X04 (XXX = 060 to 075 step 5), SMDXXXX-2X12 (XXX = 090 to 110 step 5), SMDXXXX-2X10 (XXX = 075 to 095 step 5), SMDXXXX-2X06 (XXX = 045 to 055 step 5), SMDXXXX-2X04 (XXX = 030 to 035 step 5).
Model Series SMDXXXX-6X12 (XXX = 275 to 340 step 5), SMDXXXX-6X10 (XXX = 230 to 280 step 5),
SMDXXXX-4X12 (XXX = 185 to 225 step 5), SMDXXXX-4X10 (XXX = 155 to 190 step 5), SMDXXXX-4X06 (XXX = 090 to 110 step 5), SMDXXXX-2X12 (XXX = 090 to 110 step 5), SMDXXXX-2X10 (XXX = 075 to 095 step 5), SMDXXXX-2X06 (XXX = 045 to 055 step 5).

CSA Group Inc. 2016-05-18 Page 1

鉴衡认证
JIANHENG CERTIFICATION

太阳能光伏产品金太阳认证证书

证书编号: GZC202001020438

申请人/申请者: 上海(德商)新特光伏科技有限公司
中国上海市松江区新场镇新场村1号
编址/联系地址: 上海(德商)新特光伏科技有限公司
新加坡坡中街新特光伏科技园1号
申请人/地址: 上海(德商)新特光伏科技有限公司
新加坡坡中街新特光伏科技园1号

产品名称: 德国特选单晶硅光伏组件
品牌: **SUNMAN**
型号: 德国特选单晶(4.4.4.4)
主要性能参数: 详见证书附件(第4页)
标准: 技术规范: GB/T 18709-1-2016, GB/T 18709-2-2016;
UL: 6170-1-2016, UL 6170-2-2016
认证机构: 国家认监委 + 上海工厂获证 + 最佳质量奖
上述产品符合 GB/T 18709-1-2016 及 GB/T 18709-2-2016 认证技术规范(德国特选单晶硅光伏组件)要求。
特别注明:
本证书与证书目录及证书使用规范同时使用时方为有效。获证企业在生产设计及制造方面
的所有证书须经本机构审核,否则非证书有效。

鉴衡:  **GNAS** 国家认证认可监督管理委员会
国家认证认可监督管理委员会
国家认证认可监督管理委员会
北京鉴衡认证中心有限公司
地址: 中国北京昌平区未来科学城回龙观镇龙域南路 100 号 邮编: www.gnasc.com.cn

eArc is the first module of its kind to pass the IEC 61215:2016, IEC61730:2016, UL61730 (USA) and CGC (China).



Further Durability Testing

IEC 60068-2-68
Blowing Sand Test Lc 1
Confirmation of test results

VDE Renewables File Ref.: 10398/ ET-20210823-165

Applicant: Sunman (Zhenjiang) Company Limited
No. 1 Mingzhu South Road, Youfang Town, Yangzhou City, 212218 Zhenjiang, Jiangsu, China

Product: Crystalline silicon Photovoltaic (PV)-Modules

Type:

A) SM5000M-4X120W	B) SM5000M-4X150W	C) SM5000M-4X120W
D) SM5000M-4X150W	E) SM5000M-4X120W	F) SM5000M-4X150W
G) SM5000M-4X120W	H) SM5000M-4X150W	I) SM5000M-4X120W
J) SM5000M-4X150W	K) SM5000M-4X120W	L) SM5000M-4X150W
M) SM5000M-4X120W	N) SM5000M-4X150W	O) SM5000M-4X120W
P) SM5000M-4X150W	Q) SM5000M-4X120W	R) SM5000M-4X150W
S) SM5000M-4X120W	T) SM5000M-4X150W	U) SM5000M-4X120W
V) SM5000M-4X150W	W) SM5000M-4X120W	X) SM5000M-4X150W
Y) SM5000M-4X120W	Z) SM5000M-4X150W	AA) SM5000M-4X120W
AB) SM5000M-4X150W	AC) SM5000M-4X120W	AD) SM5000M-4X150W
AE) SM5000M-4X120W	AF) SM5000M-4X150W	AG) SM5000M-4X120W
AH) SM5000M-4X150W	AI) SM5000M-4X120W	AJ) SM5000M-4X150W
AK) SM5000M-4X120W	AL) SM5000M-4X150W	AM) SM5000M-4X120W
AN) SM5000M-4X150W	AO) SM5000M-4X120W	AP) SM5000M-4X150W
AQ) SM5000M-4X120W	AR) SM5000M-4X150W	AS) SM5000M-4X120W
AT) SM5000M-4X150W	AU) SM5000M-4X120W	AV) SM5000M-4X150W
AW) SM5000M-4X120W	AX) SM5000M-4X150W	AY) SM5000M-4X120W
AZ) SM5000M-4X150W		

XXX in the type replaces the power in watt and can be any number between:
270 - 380 for G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z, AA, AB, AC, AD, AE, AF, AG, AH, AI, AJ, AK, AL, AM, AN, AO, AP, AQ, AR, AS, AT, AU, AV, AW, AX, AY, AZ

Manufacturer: Sunman (Zhenjiang) Company Limited
Standard: IEC 60068-2-68, Dust and Sand Test Lc1
Based on: IEC 61701:2011

Test sequence:

Test conditions:

Dust concentration:	4.8 - 6.3 g/m ³
Wind velocity:	18.3 - 20.7 m/s
Particle size:	Variant 3, <550 µm
Dust composition:	Quartz, 95% SiO ₂
Testing time:	Front side: 4 h, Rear side: 4 h

File Ref.: 10398/ ET-20210823-165 Page 1 of 2

IEC 61701:2020
Salt mist corrosion testing of photovoltaic (PV) modules
Confirmation of test results

VDE Renewables File Ref.: 10398/ ET-20220711-121

Applicant: Sunman (Zhenjiang) Company Limited
No. 1 Mingzhu South Road, Youfang Town, Yangzhou City, 212218 Zhenjiang, Jiangsu, China

Product: Crystalline silicon Photovoltaic (PV)-Modules

Type:

IE) SMF5000L-12X110W	IE) SMF5000L-12X120W	IF) SMF5000L-12X100W
IF) SMF5000L-12X110W	IF) SMF5000L-12X120W	IG) SMF5000L-12X100W
IG) SMF5000L-12X110W	IG) SMF5000L-12X120W	IH) SMF5000L-12X100W
IH) SMF5000L-12X110W	IH) SMF5000L-12X120W	II) SMF5000L-12X100W
II) SMF5000L-12X110W	II) SMF5000L-12X120W	IJ) SMF5000L-12X100W
IJ) SMF5000L-12X110W	IJ) SMF5000L-12X120W	IK) SMF5000L-12X100W
IK) SMF5000L-12X110W	IK) SMF5000L-12X120W	IL) SMF5000L-12X100W
IL) SMF5000L-12X110W	IL) SMF5000L-12X120W	IM) SMF5000L-12X100W
IM) SMF5000L-12X110W	IM) SMF5000L-12X120W	IN) SMF5000L-12X100W
IN) SMF5000L-12X110W	IN) SMF5000L-12X120W	IO) SMF5000L-12X100W
IO) SMF5000L-12X110W	IO) SMF5000L-12X120W	IP) SMF5000L-12X100W
IP) SMF5000L-12X110W	IP) SMF5000L-12X120W	IQ) SMF5000L-12X100W
IQ) SMF5000L-12X110W	IQ) SMF5000L-12X120W	IR) SMF5000L-12X100W
IR) SMF5000L-12X110W	IR) SMF5000L-12X120W	IS) SMF5000L-12X100W
IS) SMF5000L-12X110W	IS) SMF5000L-12X120W	IT) SMF5000L-12X100W
IT) SMF5000L-12X110W	IT) SMF5000L-12X120W	IU) SMF5000L-12X100W
IU) SMF5000L-12X110W	IU) SMF5000L-12X120W	IV) SMF5000L-12X100W
IV) SMF5000L-12X110W	IV) SMF5000L-12X120W	IW) SMF5000L-12X100W
IW) SMF5000L-12X110W	IW) SMF5000L-12X120W	IX) SMF5000L-12X100W
IX) SMF5000L-12X110W	IX) SMF5000L-12X120W	IY) SMF5000L-12X100W
IY) SMF5000L-12X110W	IY) SMF5000L-12X120W	IZ) SMF5000L-12X100W

XXX in the type replaces the power in watt and can be any number between:
400 - 550 for IE, IF, IG, IH, II, IJ, IK, IL, IM, IN, IO, IP, IQ, IR, IS, IT, IU, IV, IW, IX, IY, IZ

Manufacturer: Sunman (Zhenjiang) Company Limited
Standard: IEC 61701:2020, Salt mist corrosion testing

Test conditions:

Test method:	8
Testing time:	1440 hrs
Chamber temperature:	35°C
Relative Humidity:	95 %
Mist pH level:	3.5

VDE RENEWABLES GmbH
Sonnenschein 30
48156 Ahaus, Germany
Managing Director: Bernhard Heister

Tel: +49 (0)59 6330 3300
Fax: +49 (0)59 6330 3302
Email: info@vde-renewables.com
www.vde-renewables.com

Location: Ahaus
DIN EN ISO 9001:2015
DIN EN ISO 14001:2015
Registration No. 11813380
No. Number: 030-111-00700

Bank Information:
Deutsche Bank AG
Chausseestraße 65
48156 Ahaus, Germany
IBAN: DE 14 050 000 0001 0000 0001 0000 0000 0000 0000
BIC: BFSW3333

IEC 62716:2013
Photovoltaic (PV) modules
- Ammonia corrosion testing -
Confirmation of test results

VDE Renewables File Ref.: 10398/ ET-20210823-165

Applicant: Sunman (Zhenjiang) Company Limited
No. 1 Mingzhu South Road, Youfang Town, Yangzhou City, 212218 Zhenjiang, Jiangsu, China

Product: Crystalline silicon Photovoltaic (PV)-Modules

Type:

JA) SM5000M-4X120W	JB) SM5000M-4X150W	JC) SM5000M-4X120W
JD) SM5000M-4X150W	JE) SM5000M-4X120W	JF) SM5000M-4X150W
JG) SM5000M-4X120W	JH) SM5000M-4X150W	JI) SM5000M-4X120W
JJ) SM5000M-4X150W	JK) SM5000M-4X120W	JL) SM5000M-4X150W
JM) SM5000M-4X120W	JN) SM5000M-4X150W	JO) SM5000M-4X120W
JP) SM5000M-4X150W	JQ) SM5000M-4X120W	JR) SM5000M-4X150W
JS) SM5000M-4X120W	JT) SM5000M-4X150W	JU) SM5000M-4X120W
JV) SM5000M-4X150W	JW) SM5000M-4X120W	JX) SM5000M-4X150W
JY) SM5000M-4X120W	JZ) SM5000M-4X150W	KA) SM5000M-4X120W
KB) SM5000M-4X150W	KC) SM5000M-4X120W	KD) SM5000M-4X150W
KE) SM5000M-4X120W	KE) SM5000M-4X150W	KF) SM5000M-4X120W
KF) SM5000M-4X150W	KF) SM5000M-4X120W	KG) SM5000M-4X150W
KG) SM5000M-4X120W	KG) SM5000M-4X150W	KH) SM5000M-4X120W
KH) SM5000M-4X150W	KH) SM5000M-4X120W	KI) SM5000M-4X150W
KI) SM5000M-4X120W	KI) SM5000M-4X150W	KJ) SM5000M-4X120W
KJ) SM5000M-4X150W	KJ) SM5000M-4X120W	KK) SM5000M-4X150W
KK) SM5000M-4X120W	KK) SM5000M-4X150W	KL) SM5000M-4X120W
KL) SM5000M-4X150W	KL) SM5000M-4X120W	KM) SM5000M-4X150W
KM) SM5000M-4X120W	KM) SM5000M-4X150W	KN) SM5000M-4X120W
KN) SM5000M-4X150W	KN) SM5000M-4X120W	KO) SM5000M-4X150W
KO) SM5000M-4X120W	KO) SM5000M-4X150W	KP) SM5000M-4X120W
KP) SM5000M-4X150W	KP) SM5000M-4X120W	KQ) SM5000M-4X150W
KQ) SM5000M-4X120W	KQ) SM5000M-4X150W	KR) SM5000M-4X120W
KR) SM5000M-4X150W	KR) SM5000M-4X120W	KS) SM5000M-4X150W
KS) SM5000M-4X120W	KS) SM5000M-4X150W	KT) SM5000M-4X120W
KT) SM5000M-4X150W	KT) SM5000M-4X120W	KU) SM5000M-4X150W
KU) SM5000M-4X120W	KU) SM5000M-4X150W	KV) SM5000M-4X120W
KV) SM5000M-4X150W	KV) SM5000M-4X120W	KW) SM5000M-4X150W
KW) SM5000M-4X120W	KW) SM5000M-4X150W	KX) SM5000M-4X120W
KX) SM5000M-4X150W	KX) SM5000M-4X120W	KY) SM5000M-4X150W
KY) SM5000M-4X120W	KY) SM5000M-4X150W	KZ) SM5000M-4X120W

XXX in the type replaces the power in watt and can be any number between:
400 - 550 for JA, JB, JC, KD, KE, KF, KG, KH, KI, KJ, KK, KL, KM, KN, KO, KP, KQ, KR, KS, KT, KU, KV, KW, KX, KY, KZ

Manufacturer: Sunman (Zhenjiang) Company Limited
Standard: IEC 62716:2013, Ammonia corrosion testing

Test conditions:

Hours including heating up:	8 h
HF13-concentration (ppm):	6007
Chamber temperature:	60°C
Relative Humidity:	100 %
Hours including cooling:	16 h
HF13-concentration (ppm):	0
Chamber temperature:	23°C
Relative Humidity:	75 %

VDE RENEWABLES GmbH
Sonnenschein 30
48156 Ahaus, Germany
Managing Director: Bernhard Heister

Tel: +49 (0)59 6330 3300
Fax: +49 (0)59 6330 3302
Email: info@vde-renewables.com
www.vde-renewables.com

Location: Ahaus
DIN EN ISO 9001:2015
DIN EN ISO 14001:2015
Registration No. 11813380
No. Number: 030-111-00700

Bank Information:
Deutsche Bank AG
Chausseestraße 65
48156 Ahaus, Germany
IBAN: DE 14 050 000 0001 0000 0000 0000 0000 0000 0000
BIC: BFSW3333

IEC TS 62804-1:2015
Photovoltaic (PV) Modules - Test Methods for the detection of potential-induced degradation
Part 1: Crystalline silicon
Confirmation of test results

VDE Renewables File Ref.: 10398/ ET-20230518-116

Applicant: Sunman (Zhenjiang) Company Limited
No. 1 Mingzhu South Road, Youfang Town, Yangzhou City, 212218 Zhenjiang, Jiangsu, China

Product: Crystalline silicon Photovoltaic (PV)-Modules

Type:

CK) SMF5000F-4X120W	CV) SMF5000F-4X150W	CW) SMF5000F-4X120W
CK) SMF5000F-4X150W	CV) SMF5000F-4X120W	CW) SMF5000F-4X150W

XXX in the type replaces the power in Watt and can be any number between:
415 - 440 for CK), CV) 455 - 480 for CW), C)

Manufacturer: Sunman (Zhenjiang) Company Limited
Standard: IEC TS 62804-1:2015

Test conditions:

Testing time:	96 h
Chamber temperature:	85°C
Relative Humidity:	85 %
Potential to ground:	± 1500 V
Power degradation:	< 5%
Dry Insulation:	> 40 MΩm ²
Wet Insulation:	> 40 MΩm ²

Pass criteria:

Date	Status	Revision
02-09-2020	Final	02

Straightforward
Mauritslaan 49, 6129 EL
Utrecht, Netherlands
+31 (0) 88 1662700
info@straightforward.nl
www.straightforward.nl

VDE RENEWABLES GmbH
Sonnenschein 30
48156 Ahaus, Germany
Managing Director: Bernhard Heister

Tel: +49 (0)59 6330 3300
Fax: +49 (0)59 6330 3302
Email: info@vde-renewables.com
www.vde-renewables.com

Location: Ahaus
DIN EN ISO 9001:2015
DIN EN ISO 14001:2015
Registration No. 11813380
No. Number: 030-111-00700

Bank Information:
Deutsche Bank AG
Chausseestraße 65
48156 Ahaus, Germany
IBAN: DE 14 050 000 0001 0000 0000 0000 0000 0000 0000
BIC: BFSW3333

Bankability Report Sunman eRche modules

Sunman(Zhenjiang) Co.,Ltd.

SVMAN

Straightforward
Mauritslaan 49, 6129 EL
Utrecht, Netherlands
+31 (0) 88 1662700
info@straightforward.nl
www.straightforward.nl

VDE RENEWABLES GmbH
Sonnenschein 30
48156 Ahaus, Germany
Managing Director: Bernhard Heister

Tel: +49 (0)59 6330 3300
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Registration No. 11813380
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Bank Information:
Deutsche Bank AG
Chausseestraße 65
48156 Ahaus, Germany
IBAN: DE 14 050 000 0001 0000 0000 0000 0000 0000 0000
BIC: BFSW3333

Dust Testing

Salt Mist Corrosion
Testing level 8

Ammonia Testing

PID Testing

Straightforward Module
Bankability Testing

Extensive Fire Testing

**Materialprüfungsanstalt
Universität Stuttgart**
Postfach 801149 - D-70511 Stuttgart
Telefon: (0711) 695 - 0

MPA Materialprüfungsanstalt
Universität Stuttgart
Vom DIBt anerkannte PÜZ-Stelle
Kennnummer BWU-03

Abteilung Brandschutz - Referat Brandverhalten von Baustoffen

Allgemeines bauaufsichtliches Prüfzeugnis

Prüfzeugnis-Nummer: **P-BWU03-I-16.3.455**

Gegenstand: Gegen Flugfeuer und strahlende Wärme widerstandsfähige Bedachung mit PV-Modul „eArc“ für unbeschränkte Dachneigungen, nach Verwaltungsvorschrift des Umweltministeriums und des Wirtschaftsministeriums über Technische Baubestimmungen (VwV TB) Baden-Württemberg vom 20. Dezember 2017, Lfd. Nr. C-4.8

Antragsteller: Sunman (Zhenjiang) Company Limited
No. 1 Mingzhu South Road
Youfang Town, Yangzhong City
Zhenjiang, Jiangsu
CHINA

Ausstellungsdatum: 14. Oktober 2021

Geltungsdauer bis: 31. Oktober 2026

Aufgrund dieses allgemeinen bauaufsichtlichen Prüfzeugnisses ist der oben genannte Gegenstand im Sinne der Landesbauordnungen anwendbar.

Dieses allgemeine bauaufsichtliche Prüfzeugnis umfasst 6 Seiten und 1 Anlage. Gerüstbestand und Erläuterungen ist Stuttgart.

Materialprüfungsanstalt Universität Stuttgart
Platteneckring 32
70569 Stuttgart (Vaihingen)
URL: www.mpa.uni-stuttgart.de

Telefon: (0711) 695 - 0
Telefax: (0711) 695 - 01930
Internet: www.mpa.uni-stuttgart.de

BW-Bank Stuttgart | LBStB
Konto-Nr.: 3 671 001 001 | IBAN: DE44 2512 0510 0001 0211 0001 0001
BIC: SWIFT Code: SOLADE33XXX
09/2021 - MA/VTB

TRASFERIMENTO TECNOLOGICO
INNOVAZIONE
SISTEMA CAMERALE VENETO

ACCREDIA
CONFORME ALLA
NORMA UNI EN ISO 9001

LAB N° 0170 L
egolf

General Membrane SPA
Via Venezia, 53B
30022 Ceggia (VE)

EN 13501-5:2016: Classificazione al fuoco dei prodotti e degli elementi da costruzione - Parte 5: Classificazione in base ai risultati delle prove di esposizione dei tetti a un fuoco esterno

EN 13501-5:2016: Fire classification of construction products and building elements
Part 5: Classification using data from external fire exposure to roof tests

- Rapporto di classificazione n° 1727/21
- Classification report n°:
- Emesso in data: 2021-02-17
- Date of issue:
- Nome o modello del prodotto ⁽¹⁾: SOLAR PV MONO ARC PHOTOVOLTAIC MODULE
- Product name or model ⁽¹⁾:

Introduzione
Introduction

Questo rapporto di classificazione definisce la classe assegnata al tetto SOLAR PV MONO ARC PHOTOVOLTAIC MODULE in accordo con le procedure indicate nella norma EN 13501-5:2016.
This classification report defines the classification assigned to roof-covering SOLAR PV MONO ARC PHOTOVOLTAIC MODULE in accordance with the procedures given in EN 13501-5:2016.

La riproduzione del presente documento è ammessa solo in copia integrale. La riproduzione parziale o la ristampa è ammessa soltanto a seguito di autorizzazione scritta di ICI - Trasferimento Tecnologico e Innovazione s.r.l. ed il numero di prodotto dell'autorizzazione va riportato in testa alla riproduzione e ristampa. Il presente documento è in formato bilingue (italiano e inglese). In caso di dubbio è valida la versione in lingua italiana. Tutti i dati descrittivi delle campioni riportati nel presente rapporto di prova e contrassegnati con ⁽¹⁾, sono stati forniti dal cliente. Il laboratorio ne detiene ogni responsabilità.

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RIC. FUC. N. 03 del 2021-02-12 pagina 1 di 4

ICI - Trasferimento tecnologico e innovazione s.r.l.

Sede legale e operativa: Piazza delle Industrie, 34/a 00187 Roma (RM) Tel: +39 06 671 5711 Fax: +39 06 671 5712
Sede operativa: Corso Porta Nuova, 05 00187 Roma (RM) Tel: +39 06 4761860 Fax: +39 06 4761861
Sede operativa: Viale Porta Adige, 45 31043 Montebelluna (TV) Tel: +39 0422 47600 Fax: +39 0422 47601
Laboratori CERT: Via Piazza Alfa, 36 31043 Montebelluna (TV) Tel: +39 0422 47600 Fax: +39 0422 47601
Organismo notificato per il CPR N° 1000: Anagrafe Nazionale della Ricerca cod. 0100001000 Incubatore certificato d'impresa certificata C.F. PIVA 0434304032

L.S.Fire
TESTING INSTITUTE

L.S. FIRE TESTING INSTITUTE S.R.L.
Via Ogliastra, 15 - 22070 Oltrepo di San Marnette (CO) - Italy
Via della Sanonica, 4 - 24401 CortinaGuerzo (TS) - Italy
Tel: +39 031 890388 - Fax: +39 031 3532853
lab@lsfire.it - www.lsfire.it

Laboratorio autorizzato dal Ministero dell'Interno con codice 15018101 del 14.06.10 (G.U. n. 140 del 12.07.10)

**CERTIFICATO DI PROVA
L.S.FIRE/U16570/03180**

Emesso ai sensi del P.A.T. 10 del decreto del Ministero dell'Interno del 26 giugno 1984 concernente "Classificazione di reazione al fuoco ed omologazione dei materiali a fini della prevenzione incendi" modificato con decreto del Ministero dell'Interno del 03 settembre 2001 (G.U. n°942 del 17 ottobre 2001).

Visto l'esito degli accertamenti effettuati si certifica che allo **INSTALLAZIONE TECNICA** (Allegato A.2.1)

prodotto da: **SUNMAN ENERGY EU GmbH**
Thurn-und Taxis-Platz, 6
60313 Frankfurt am Main (DE)

denominato: **EARC MONOCRYSTALLINE PV MODULE SMF430F-12X12UW**

impiegato come: Pannello Fotovoltaico

Descrizione	Metodo secondo la norma	Classe/Categoria Assegnabile
LATO A	UNI 8457 e 8457/A1	I
LATO B	UNI 8457 e 8457/A1	I
LATO A - LATO B	UNI 9174 e 9174/A1	II

è attribuita in conformità alla UNI 9177 la

CLASSE DI REAZIONE AL FUOCO

2 (DUE)

Il prodotto EARC MONOCRYSTALLINE PV MODULE SMF430F-12X12UW non ricade nel campo di applicazione di norme armonizzate CPT e per il prodotto medesimo della ditta SUNMAN ENERGY EU GmbH non risulta ottenuto il rilascio di ETA (European Technical Assessment), ai sensi dell'allegato IV del CPR.
Il presente certificato è valido unicamente per la campionatura sottoposta a prova.

Costituiscono parte integrante del presente certificato n° 3 (TRE) allegati con i risultati di prova e la documentazione tecnica del produttore.

Oltrepo di San Marnette, 01-08-2022

Il Direttore Tecnico
[Signature]

Il presente certificato di prova non può essere riprodotto in forma parziale senza l'autorizzazione di L.S. Fire Testing Institute srl

W000340 Page 1 di 1

MA **ICC-MPA** **CNAS** **中国合格评定国家认可委员会**
220020349097

TEST REPORT

No:2022DMWA20843

SAMPLE PV Module

MODEL/TYPE

APPLICANT VDE Global Services (Shanghai)

Wuxi Institute of Inspection, Testing and Certification
National Center of Inspection on Solar Photovoltaic Products Quality

B Roof (t1) | B Roof (t2) | UNI9177 | UL790



Further institutional recognition

School of Photovoltaic and Renewable Energy Engineering
Durability benchmarking of a light-weight polymer-based PV Module



Weiwei Zhang¹, Tingting Zhang¹, Chenggang Liang¹, Jiahongyi Zhang¹, Zhenhui Gong¹, School of Photovoltaic and Renewable Energy Engineering (SPREE), Sydney, Australia
¹SPREE, The University of New South Wales, Sydney, Australia
Email: Weiwei.Zhang@unsw.edu.au

Introduction
Durability benchmarking of innovative, lightweight polymer-based PV Modules will under the product name "eArc"
How testing process will build confidence in the long-term stability of these Modules installed in the field?

Step 1: Design
Use of dimensional drawings with well established standards (IEC 61215 and IEC 61730)
Material selection with long "proven" technology
Comprehensive Polymer Materials characterized long life in long-term testing conditions (thermal and mechanical)

Step 2: Test Regimes
IEC 61215 testing is widely standard for stability testing in a 1000-hour test regime but is it sufficient? There are known deficiencies
Deficiencies of IEC61215 | **Solution**
- Polymer substrate degradation | Assess substrate degradation, identify polymer material stability mechanism
- Corrosion | Compare IEC61215/IEC 61730 with IEC 61082
- Thermal cycling | Compare accelerated thermal cycling test (IEC 61082) with IEC 61215
- Mechanical | Compare standard environmental testing with standard stability testing
- Humidity | Compare standard environmental testing with standard stability testing
- Salt Crystals | Compare standard environmental testing with standard stability testing

Step 3: Results
Power degradation of the individual IEC 61215 test are shown in Figure 1
- Degradation is accelerated in standard modes by IEC 61730 test regimes (IEC 61082) (dark heat tests (Figure 2))
- Active modules will experience accelerated PID testing
- Temperature (55 degrees Celsius) testing to 25 years equivalent with no significant performance enhancement

Conclusions and Further Work
- Active modules pass all test of IEC 61730 tests with degradation comparable to the production of standard modules
- Active modules pass PID test equivalent to 25 years equivalent with no significant performance enhancement during field test
- The active modules are compatible with other power systems and their performance has good stability after the testing in the field
- Ongoing testing will continue to elaborate on ground, long-term or accelerated testing regimes that is associated with the best long-term

Urkunde
pv magazine
HIGHLIGHT
top innovation

Die unabhängige Jury von pv magazine Deutschland verlieht Summan für die Entwicklung der „eArc“-Module aus gelbesensibilisiertem Kunststoff das „Produkt“ „pv magazine top innovation“.

Begründung der Jury
Wenn es gelingt, haltbare und weitesensibilisierte Solaranlagen zu bauen, die leichter sind als heute, ist das Potenzial riesig. Sowohl für die Energiebranche, für die viele Photovoltaik-Anlagen nötig sind, als auch für die Anbieter. Das ist schon lange bekannt, doch die damit zusammenhängenden Herausforderungen werden noch nicht zufriedenstellend gelöst. Summan ist eine der Firmen, die nun wieder einen vielversprechenden Ansatz vorgebracht hat. Sie hat ein breites Materialangebot, die auf Glasteilen, die nur wenig Gewicht ausfallen, verbleibend, oder mit Rahmen montiert werden kann. Das Unternehmen legt etliche Tests vor, um die Langlebigkeit über 25 Jahre zu erproben. Jetzt muss sich das Produkt in der Realität beweisen. Die Jury hofft für eine wichtige Innovation und zeichnet es mit dem „Produkt“ „pv magazine top innovation“ aus.

Berlin, Mai 2019
Michael Fuchs
Chefredakteur
www.pv-magazin.de/awards

中国科学院工程力学研究所机械研究所
中国科学院工程力学研究所机械研究所
中国科学院工程力学研究所机械研究所

测试报告

客户: 某公司
委托单位: 某公司
项目负责人: 某公司
测试地点: 某公司
测试时间: 某公司

Fraunhofer ISE
Callab PV Modules

Test report
Precision measurement of photovoltaic current-voltage characteristics under STC

Customer: Summan Energy Polimercompun Fabrikung
Schoft, Matthias
Münzinger Straße 10
79111 Freiburg im Breisgau
Germany

Manufacturer Type: --
Device Type: --
Device number: 13604000900061000000000
Manufacturer: --
Manufacturer Label No.: --
Manufacturer: SUMMOET / 0019UM0000V01
Test report: --
Number of pages: 5
Test date: 01.07.2020

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Callab PV Modules
www.callab.de

gamcorp
CLEAN ENERGY COUNCIL

cRoof 产品风洞测试报告

General Information: cRoof is a lightweight solar panel that is made from a polymer substrate and a thin layer of silicon cells. It is designed to be used in areas with high wind speeds and is suitable for installation on a variety of roof types.

Information provided by Summan Energy
1. Panel Material: cRoof is made from a polymer substrate and a thin layer of silicon cells.
2. The substrate is made from a high-strength polymer material.
3. The silicon cells are made from a high-purity silicon material.

Based on the test results provided, the weight of PV panel is 3.0kg/m², which meets the IEC61215.

Windy Load (Wind-Loaded): Based on the assumption that the building roof has been designed in accordance with the requirements of IEC61215, the wind speed is 33m/s. The wind load is 0.5kN/m². The wind load is applied to the roof panel and the result is compared with the design strength of the panel. The result shows that the wind load is within the design strength of the panel.

Wind Load (Self-Weight): Since the panel is 3.0kg/m², the self-weight is 0.03kN/m². The self-weight is applied to the roof panel and the result is compared with the design strength of the panel. The result shows that the self-weight is within the design strength of the panel.

Based on our review, we conclude that the structure is suitable for the use of cRoof. The structure is designed in accordance with the requirements of IEC61215. The wind load is within the design strength of the panel. The self-weight is within the design strength of the panel.

Summan Energy
www.summanenergy.com

南京航空航天大学
1952
NUAA

cRoof 产品风洞测试报告

测试人: 曹斌
校核: 曹斌
审核: 曹斌
日期: 2019年4月

南京航空航天大学空气动力学研究所
2019年4月



eArc has been further tested and recognized by institutions such as University of New South Wales, Fraunhofer, PV Magazine, Chinese Academy of Sciences, Fraunhofer, Gamcorp, Nanjing University of Aeronautics and Astronautics.



03 Product

Products



SMF520J-12X12UW
SMF430F-12X12UW



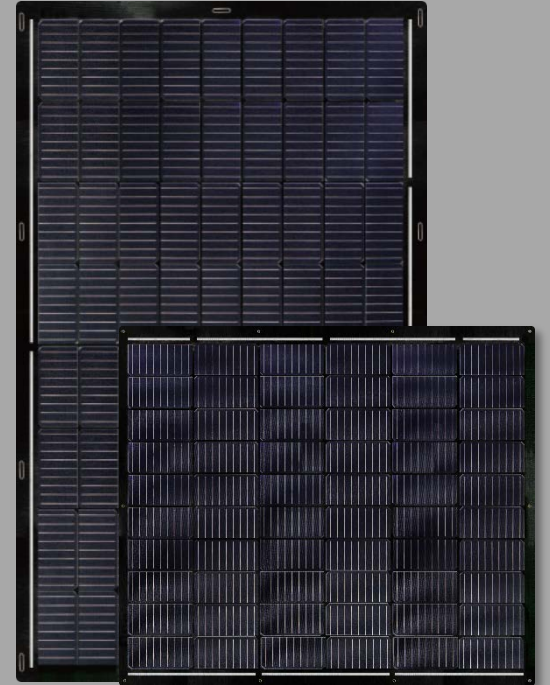
C&I

SMH520J-12X12UW



Off-grid

SMF100S-4X09UW
SMF175M-4X09UW



Balcony

SMF200J-6X10DB-e
SMF200F-8X09DB-e

Technical Specification (C&I)

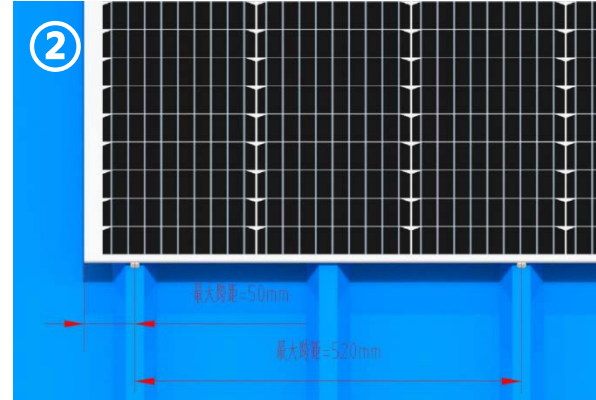
Class	Specification	SMF430F-12X12UW	SMF520J-12X12UW	SMH520J-12X12UW
Electrical characteristics	Pmax (W)	430	520	520
	Vmp (V)	42	42.3	42.3
	Imp (A)	10.24	12.31	12.31
	Voc (V)	49.8	49.5	49.5
	Isc (A)	10.74	13.56	13.56
	Max. system voltage(V)	1500	1500	1500
	Module efficiency (%)	19.3	19.3	19.3
Mechanical characteristics	Solar cells	Mono-silicon (166mm half cell)	Mono-silicon (182mm half cell)	Mono-silicon (182mm half cell)
	Dimensions (mm)	2054×1084×2	2246×1197×2	2246×1227.8×39.5
	Weight	6.3 (2.83kg/m ²)	7.7 (2.86kg/m ²)	11.1
Packaging configuration	20'GP	580	264	136
	40'HC	1320	528	272

SMF Installation Method

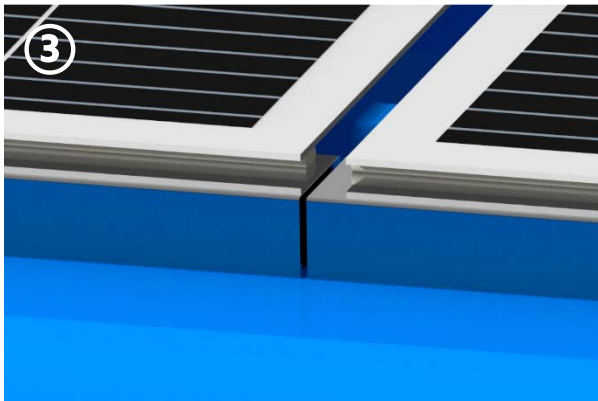
Metal Roofs



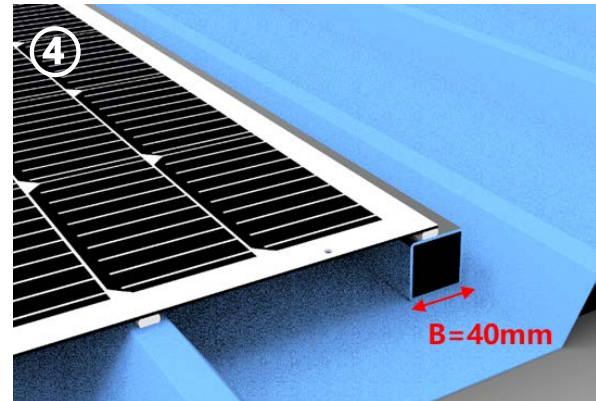
Evenly apply glue to the peaks of metal roof profile (>10mm width).



The spacing between lines of glue is $\leq 520\text{mm}$, and when the overhanging part of the module is $>50\text{mm}$, use aluminum square tube.



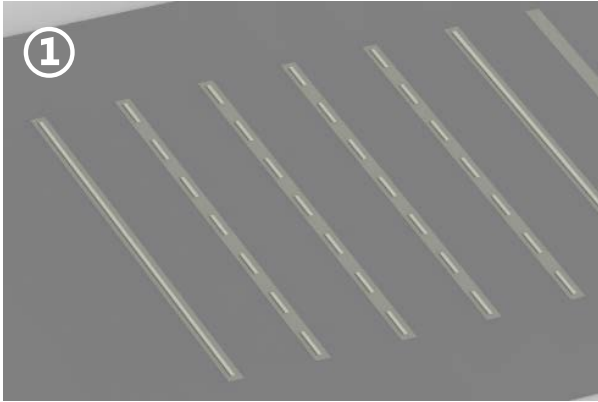
Ensure that the ends of aluminum tubes lay between panels.



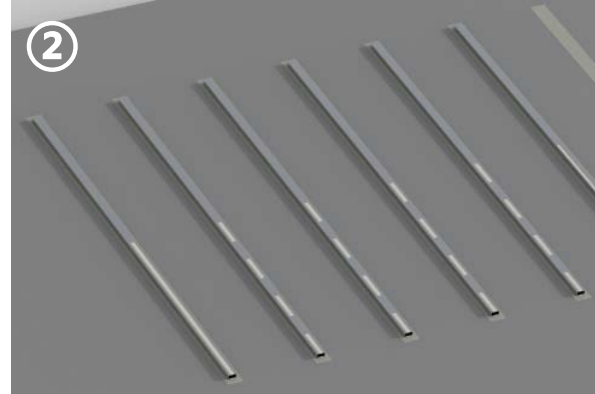
Aluminum square tube is required to be aluminum profile 6063-T5/T6, anodized AA10 or above.

SMF Installation Method

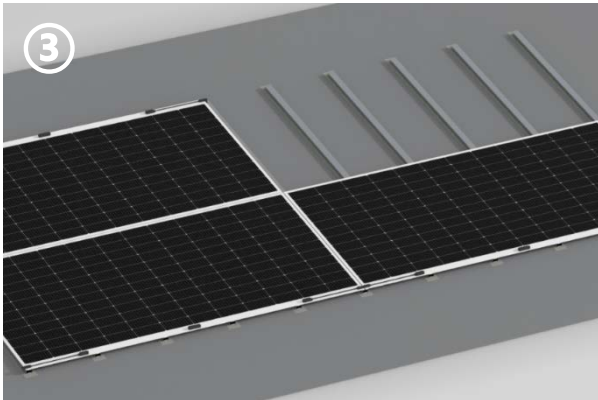
Membranes (with Tubes)



Clean the roof with the cleaning agent specified by Sunman. Apply the recommended glue that is appropriate for the roofing material.



Place tube onto the glue lines and put another layer of glue on the top side of the tube.



Place panels in the manner displayed in the diagram (430W correspond to 5 tubes, 520W correspond to 7 tubes)



Ensure a single panel is not mounted on two tubes – expansion and contraction of the tubes may cause issues, such as deformation of the panels.

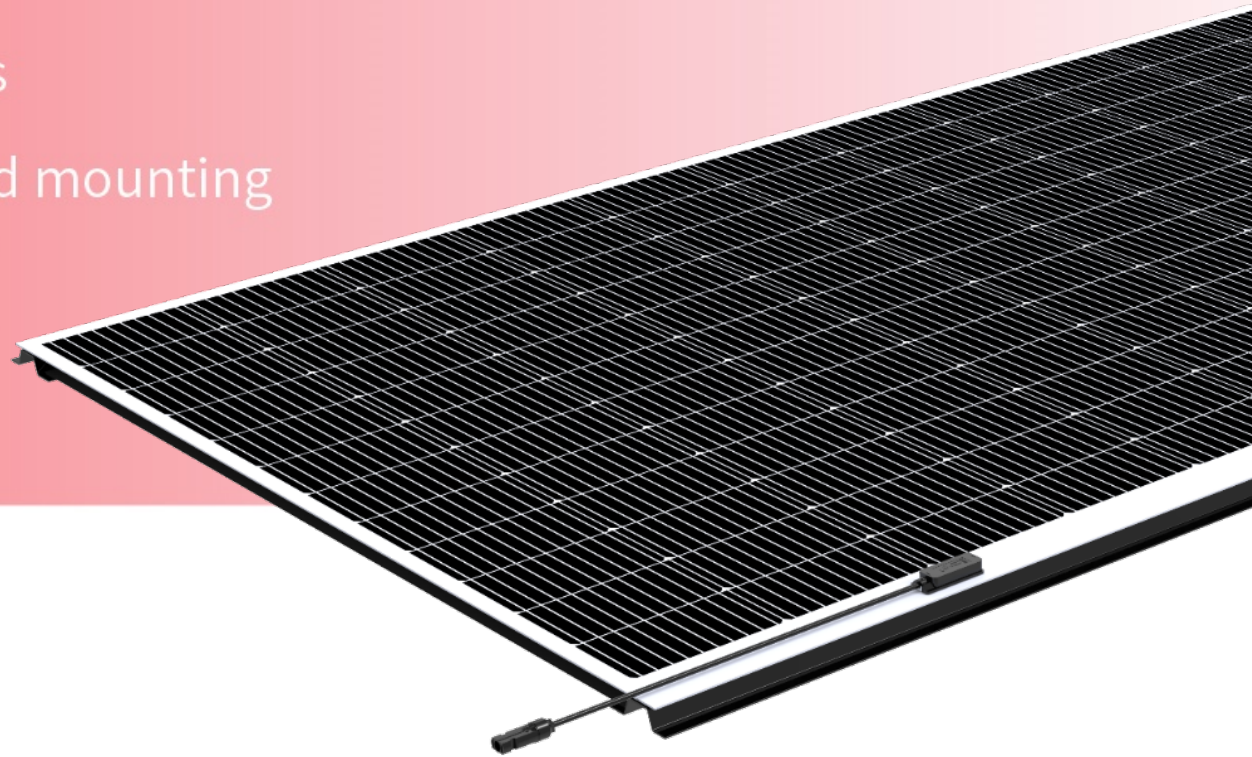
Introducing Dragonfly

A new innovation platform based on the SMF Series

520W high-efficiency PV module with pre-integrated mounting

Bringing installation steps to the fab (“I2F”)

saving on-site time and costs.



DF Installation Method

Membranes (Quick-Bonding)



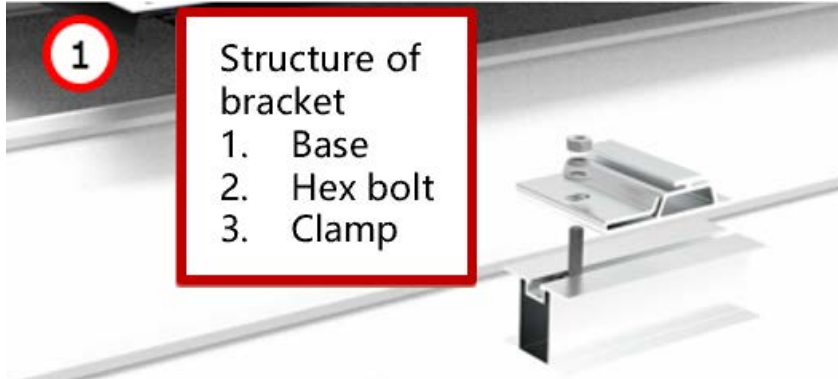
Put the DF module upright, and apply glue to backside of six short frames.



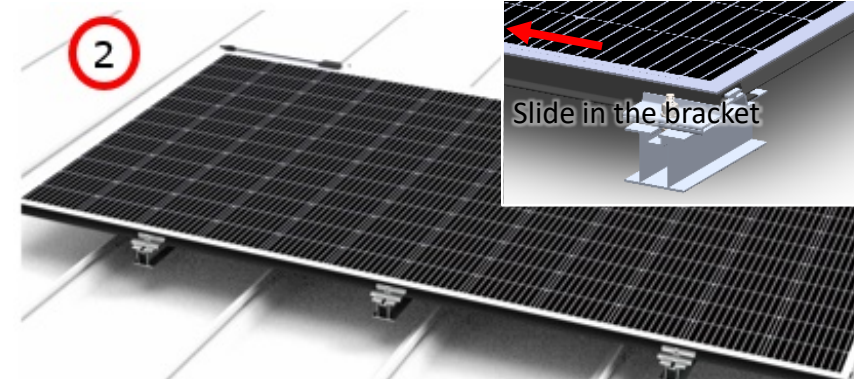
Paste the module and repeat preceding steps to finish all module installation.

DF Installation Method

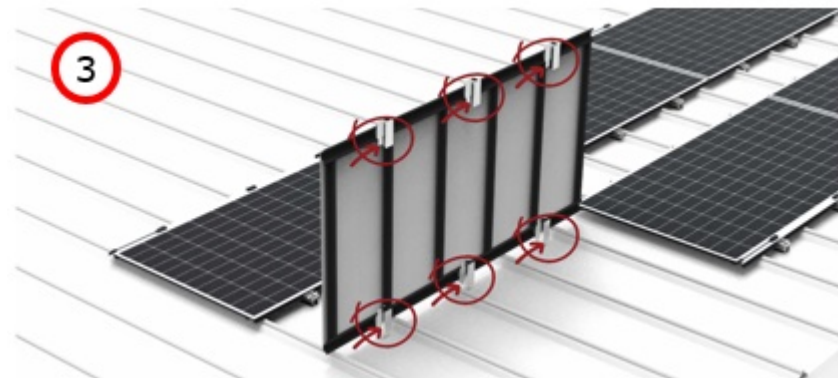
Membranes / Metal Roofs (Dismountable)



Assemble the bracket.



Install the bracket onto the prefabricated panel.



Apply glue to the base.



Paste the modules.

04 Application

C&I Applications

Roofs with Low Load Bearing Capacity



- An estimated 40% of commercial and industrial roofs lack the minimum load-bearing capacity (15 kg/m²) to support conventional glass modules.
- When buildings fall under this threshold, structural strengthening is required for solar to be installed, which is costly and disruptive to on-site business activities.
- The full installed weight of eArc modules is <4 kg per m².

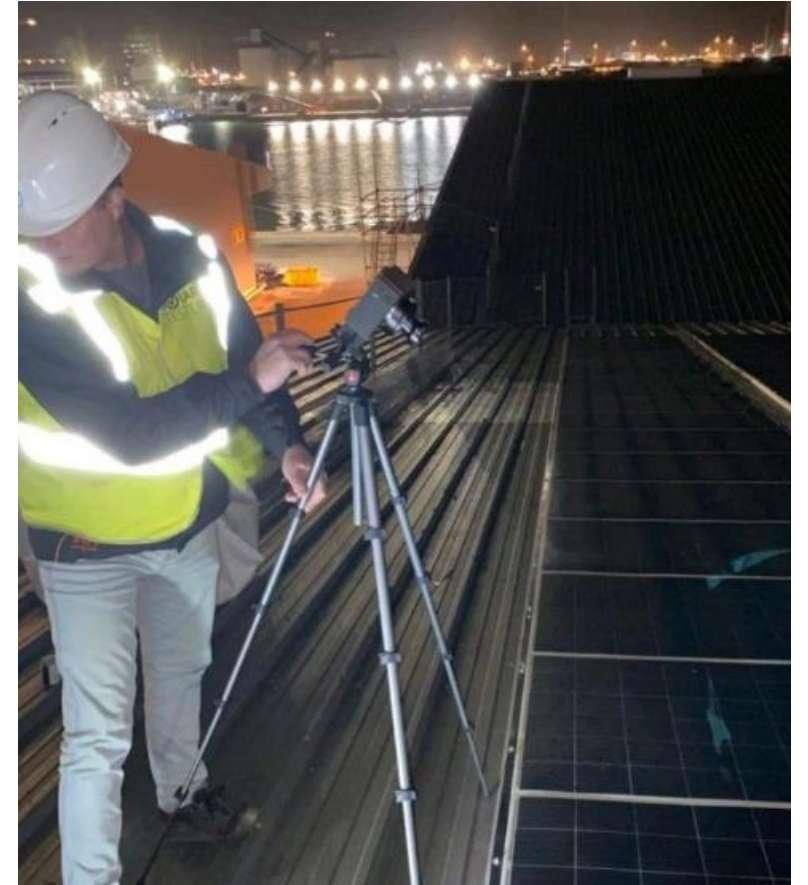
C&I Applications

Roofs with Low Load Bearing Capacity



C&I Applications

Roofs with Low Load Bearing Capacity



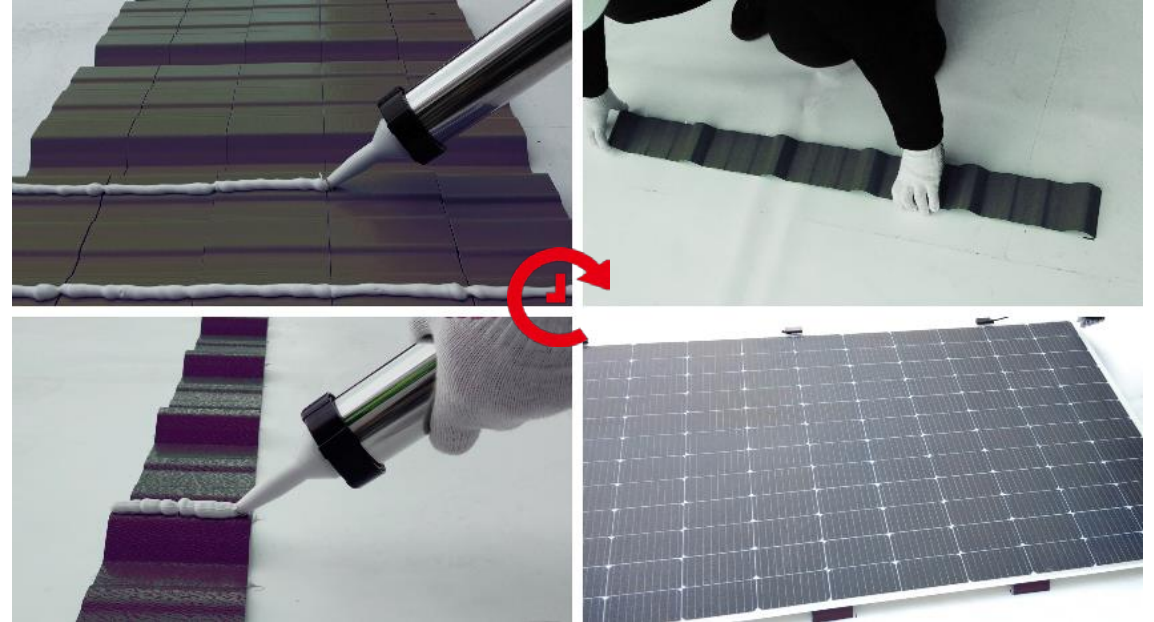
C&I Applications

Roofs with Low Load Bearing Capacity



C&I Applications

Membranes and Flat Roofs



- Roof membranes, such as TPO and PVC, are becoming increasingly popular for commercial roofs.
- Due to penetration issues, waterproofing membranes cannot accommodate conventional glass modules.
- eArc can be directly glued onto membranes with a substructure to elevate the module by 2 cm.

C&I Applications

Membranes and Flat Roofs



C&I Applications

Membranes and Flat Roofs



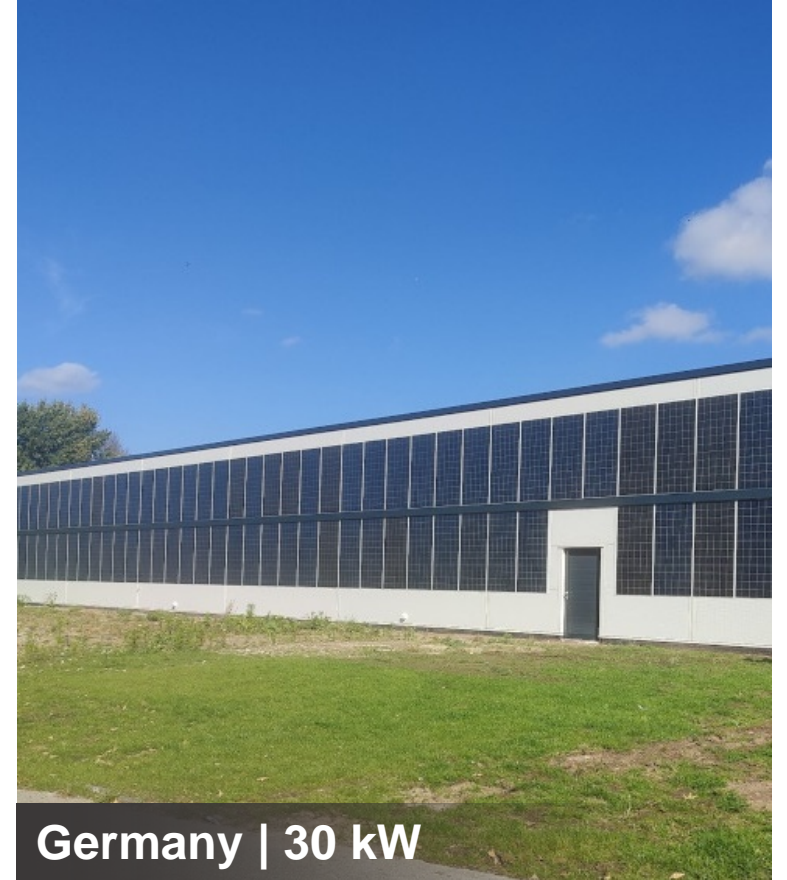
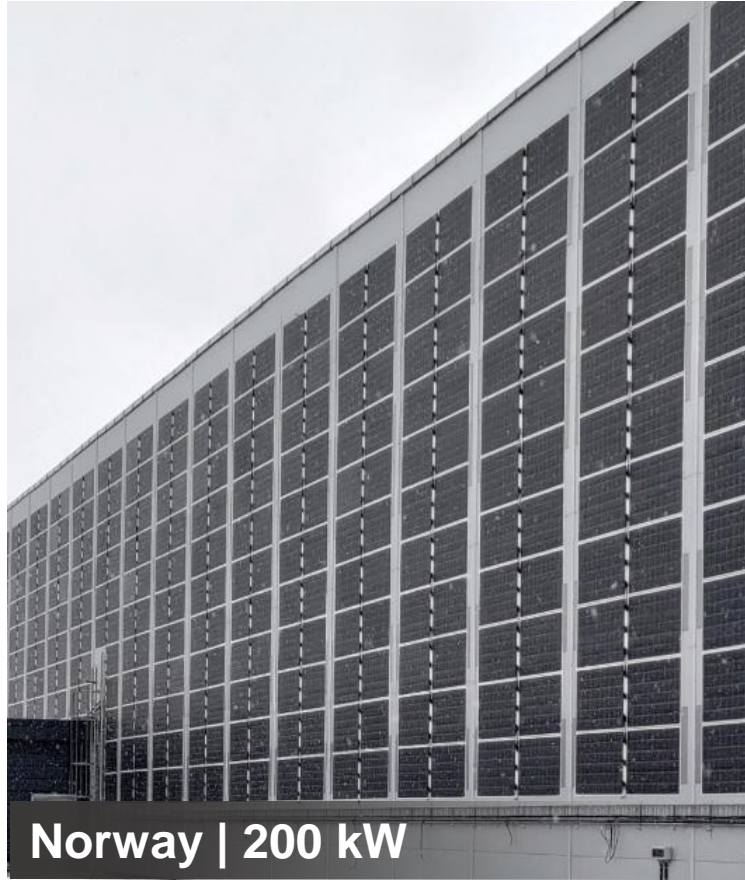
Other Applications

EV Charging Infrastructure and PV Carports



Other Applications

Facades

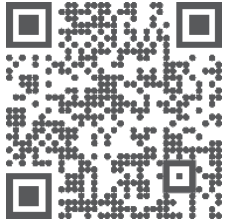


Other Applications

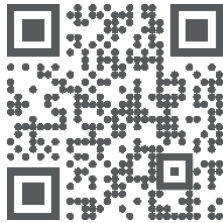
Vehicle Integrated Photovoltaics



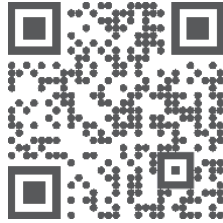
Thank You



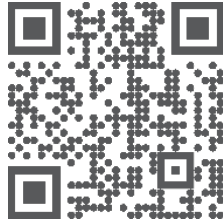
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Website



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 www.sunman-energy.com

 21 3988 2800
