

HIT[®] Photovoltaic Panels

Solar Power 2007

SANYO Energy (USA) Corporation
Solar Division

CRM Team

September, 2007

A Global Solar Company



Making Solar Products Since 1975



Growth Continues: Total HIT[®] cell production capacity becomes 260MW.

2007

The production of the HIT cells begins in B Building at Nishikinohama factory.
Total HIT cells production capacity becomes 160MW.

2005

New factory (A Building) at Nishikinohama completed.
Brand-new HIT power cell and module produced.

2004

- HIT200W PV Module released (Cell Efficiency 19.5%)
- Monterrey Factory started production.

2003

HIT PV modules marketed in N. America & Europe.

2002

World's largest PV monument,
The "Solar Ark" completed

2001

The World's first double-side PV module,
"HIT Double" started on sale

2000

HIT solar cells mass-produced and marketed

1997

1994

Residential PV systems started on sale.

1992

The first installation of a grid-connected system

1990

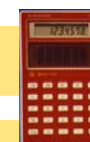
R&D for HIT solar cells started

1980

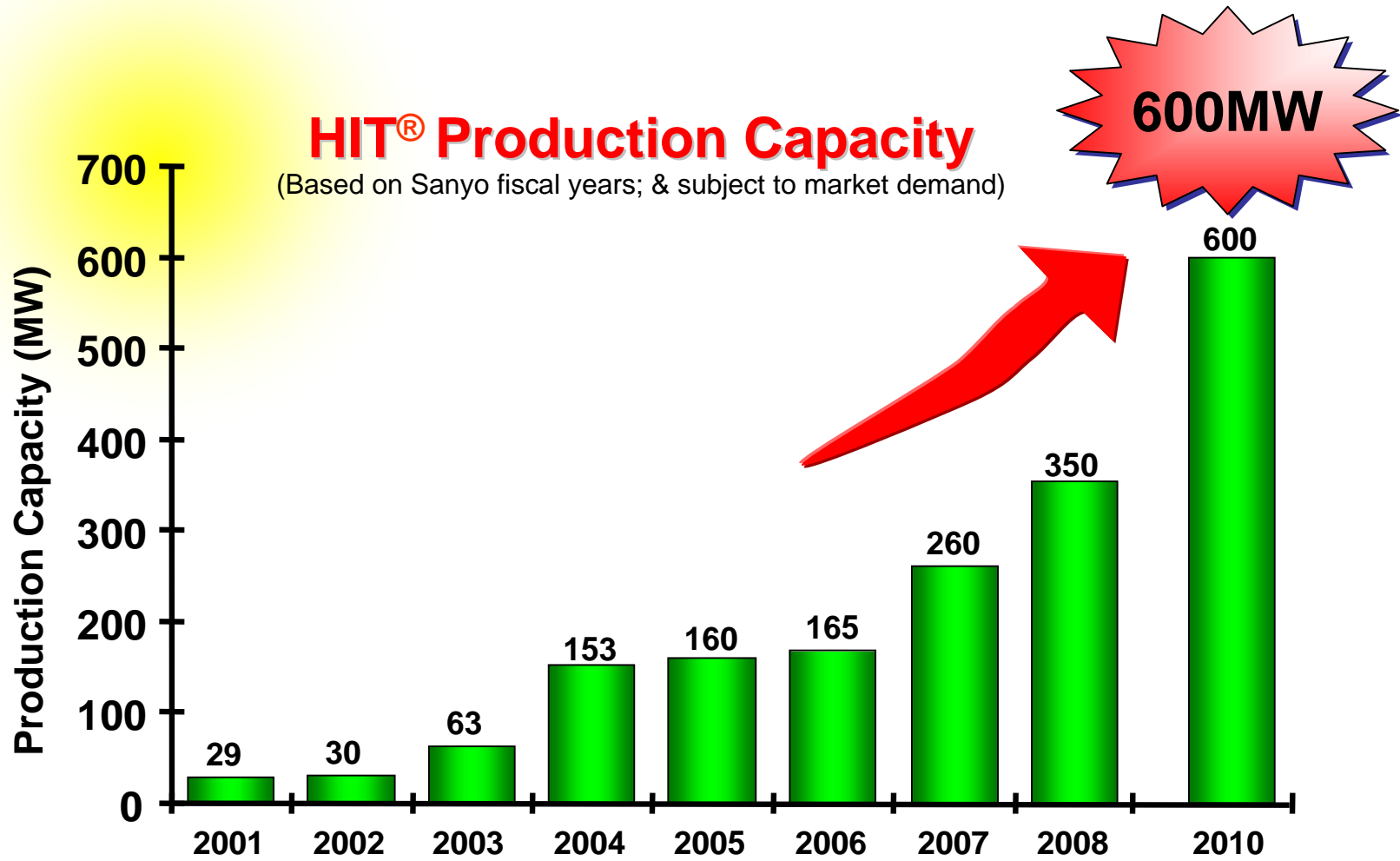
The first successful industrialization of a-Si solar cells in the world.

1975

R&D for amorphous silicon (a-Si) solar cells started.

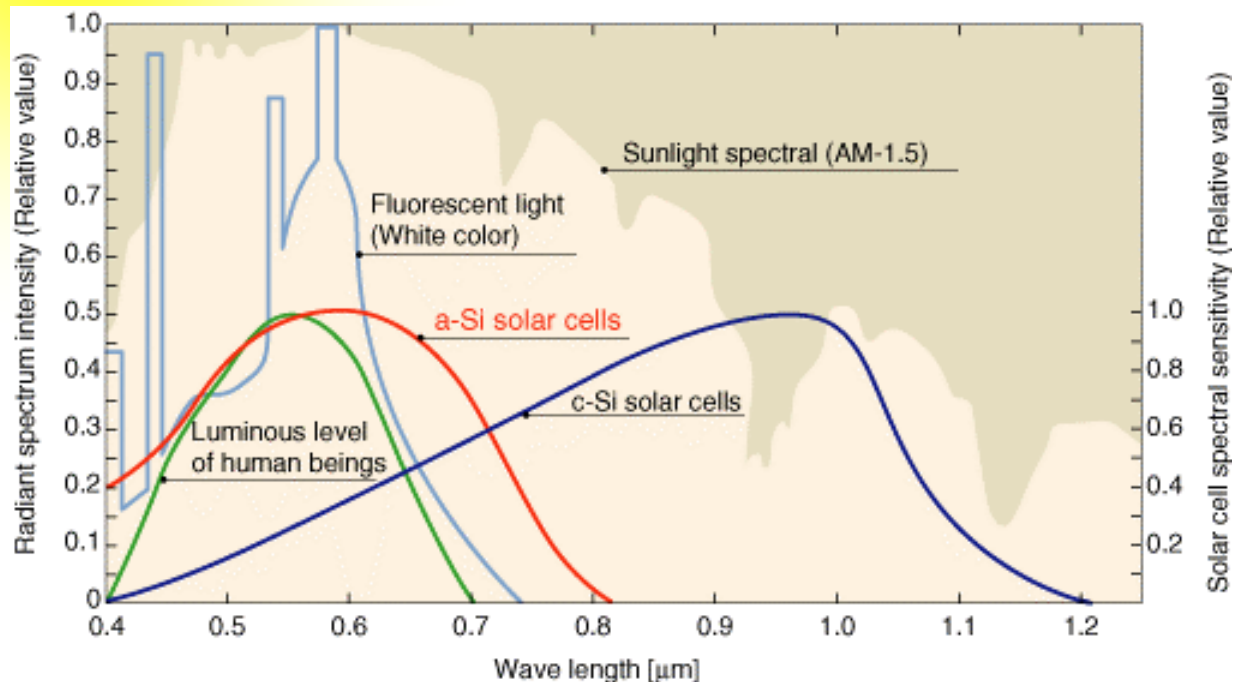


Think GAIA
For Life and the Earth



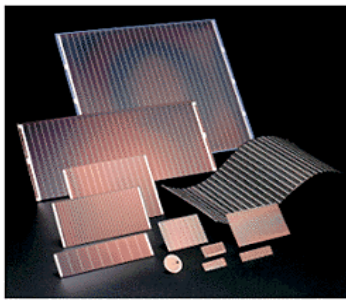


Each solar technology converts certain wave lengths of light, including visible and invisible light, into electricity.

The more light a solar technology converts into electricity, the more efficient or powerful it is.



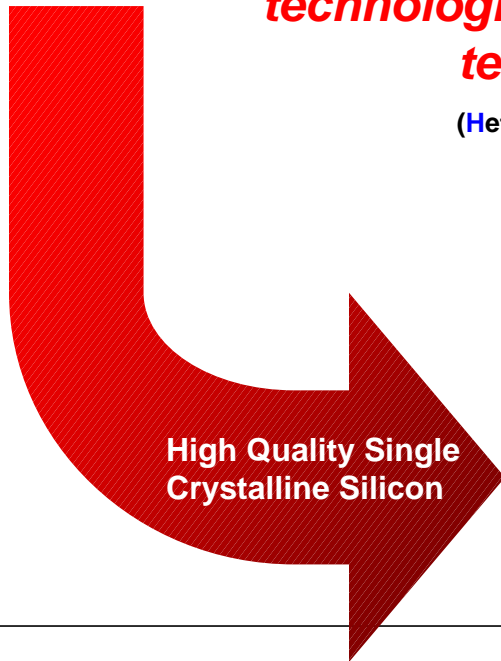
Most popular silicon solar technologies...

Single Crystalline Silicon	Multi Crystalline Silicon	Amorphous Silicon
		
Average Cell Efficiency (Mass Production) 14% to 16%	Average Cell Efficiency (Mass Production) 13% to 15%	Average Cell Efficiency (Mass Production) 6% to 8%

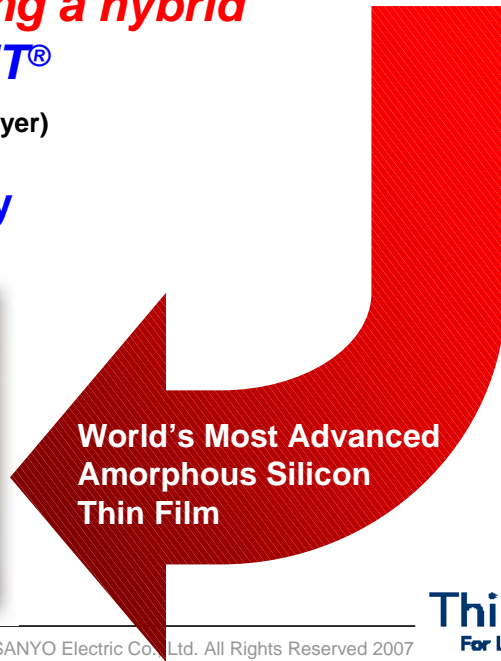
SANYO combines two of the most popular solar technologies into one, creating a hybrid technology called *HIT*[®]

(Heterojunction with Intrinsic Thin Layer)

High Level Efficiency
17.8% to 20.2%



High Quality Single Crystalline Silicon

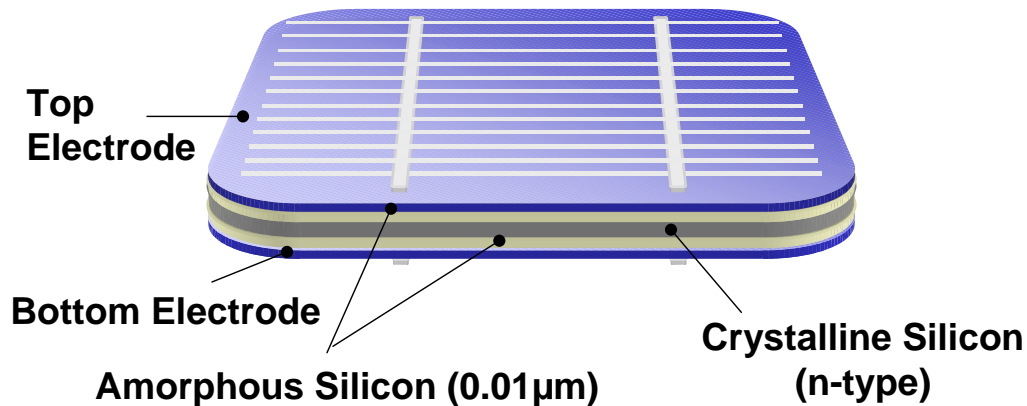


World's Most Advanced Amorphous Silicon Thin Film

HIT[®] solar cells are made at lower temperatures during the p-n junction process and use less silicon material compared to many crystalline silicon solar cells, *saving energy and materials* during mass production for a more environmentally friendly manufacturing process.

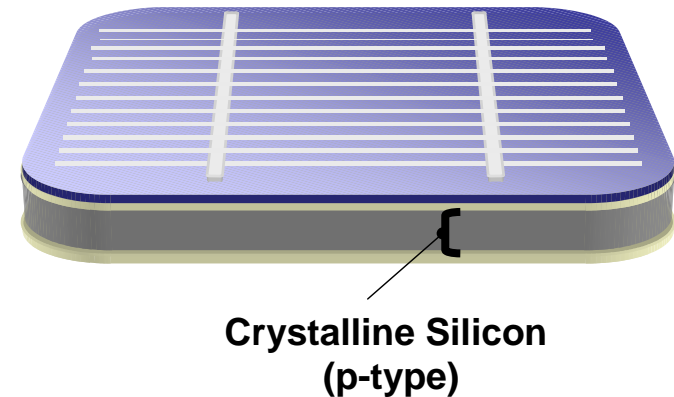
HIT Solar Cell

Manufactured at 200°C



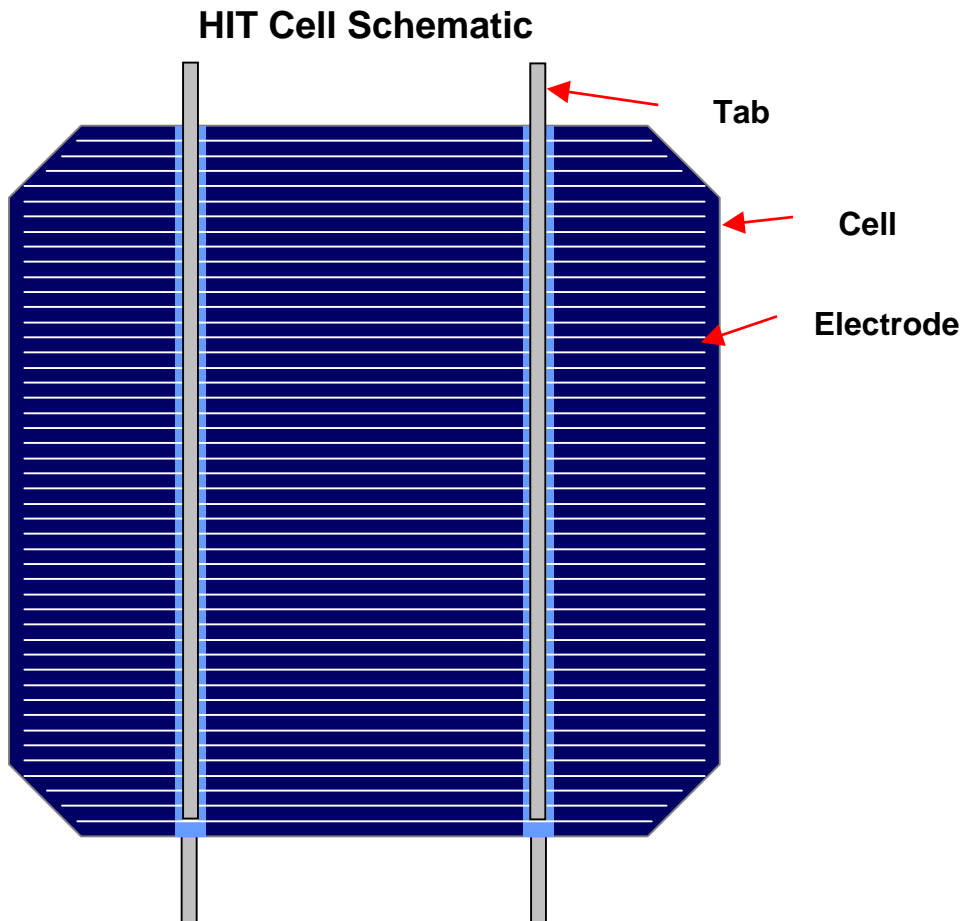
Crystalline Silicon Solar Cell

Manufactured at 900°C

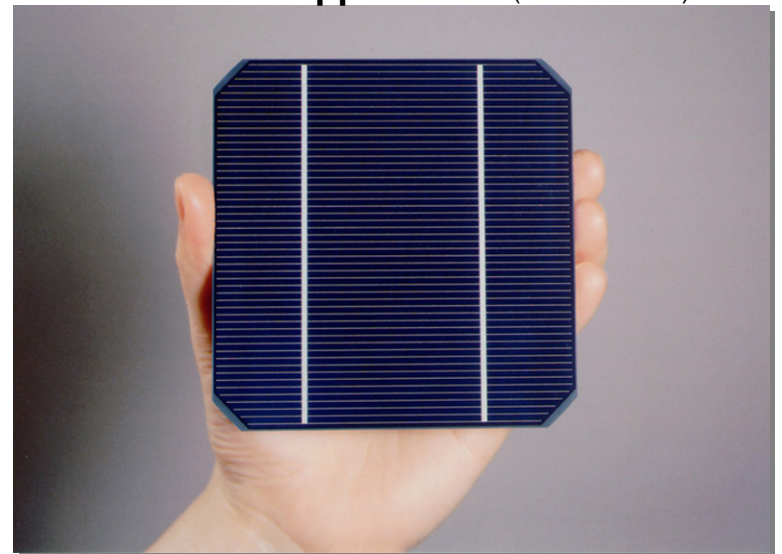


Essential Point: SANYO HIT[®] solar cells achieve up to 22.3% cell efficiency!

22.3%
R&D HIT Cell Efficiency
17.8~20.2%
(mass production)

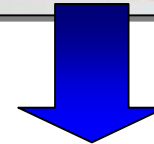
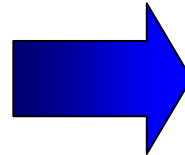


HIT Cell Appearance (Blackish-Blue)

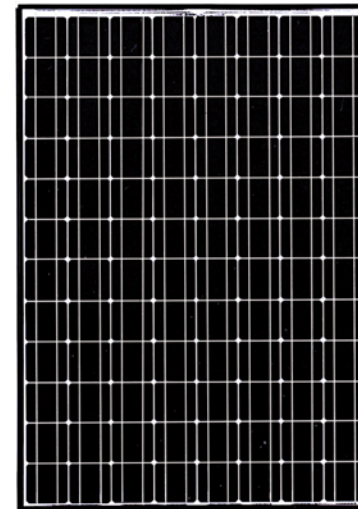


96 HIT[®] solar cells become
one **HIT** solar panel.

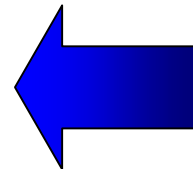
Solar panels together
make a **HIT** solar system.



180~205 Watts
(depends upon model)



**HIT Solar Panel
Appearance**

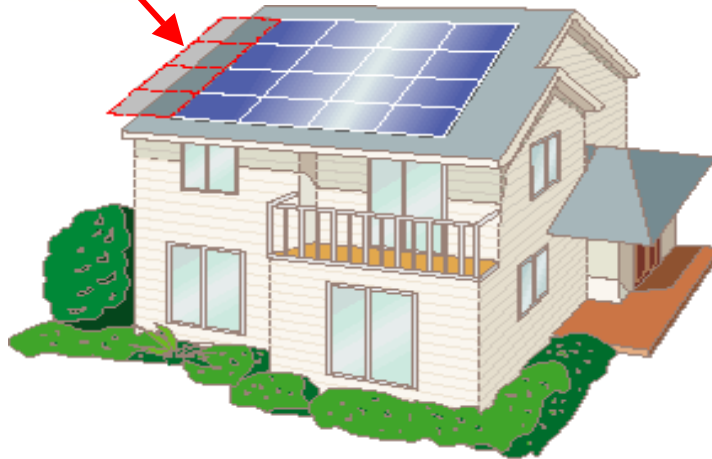


HIT Solar System



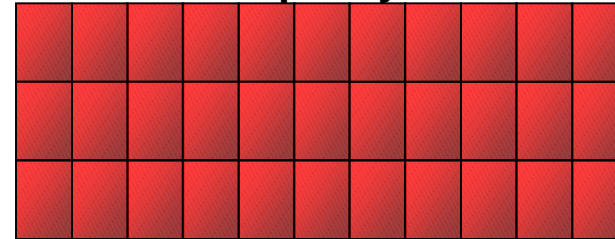
HIT[®] solar panels convert 30% more sunlight into electricity than average solar panels.

Unnecessary panels when using **HIT[®]**



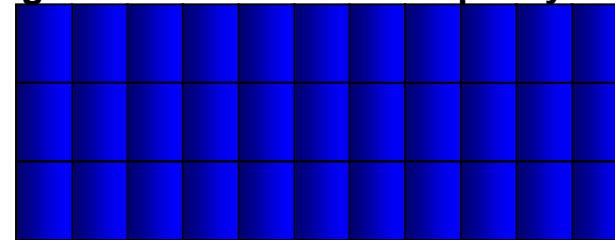
Example: 10,000 ft² space

HIT Power Capacity = 161.5kW



Advantage of High Efficiency

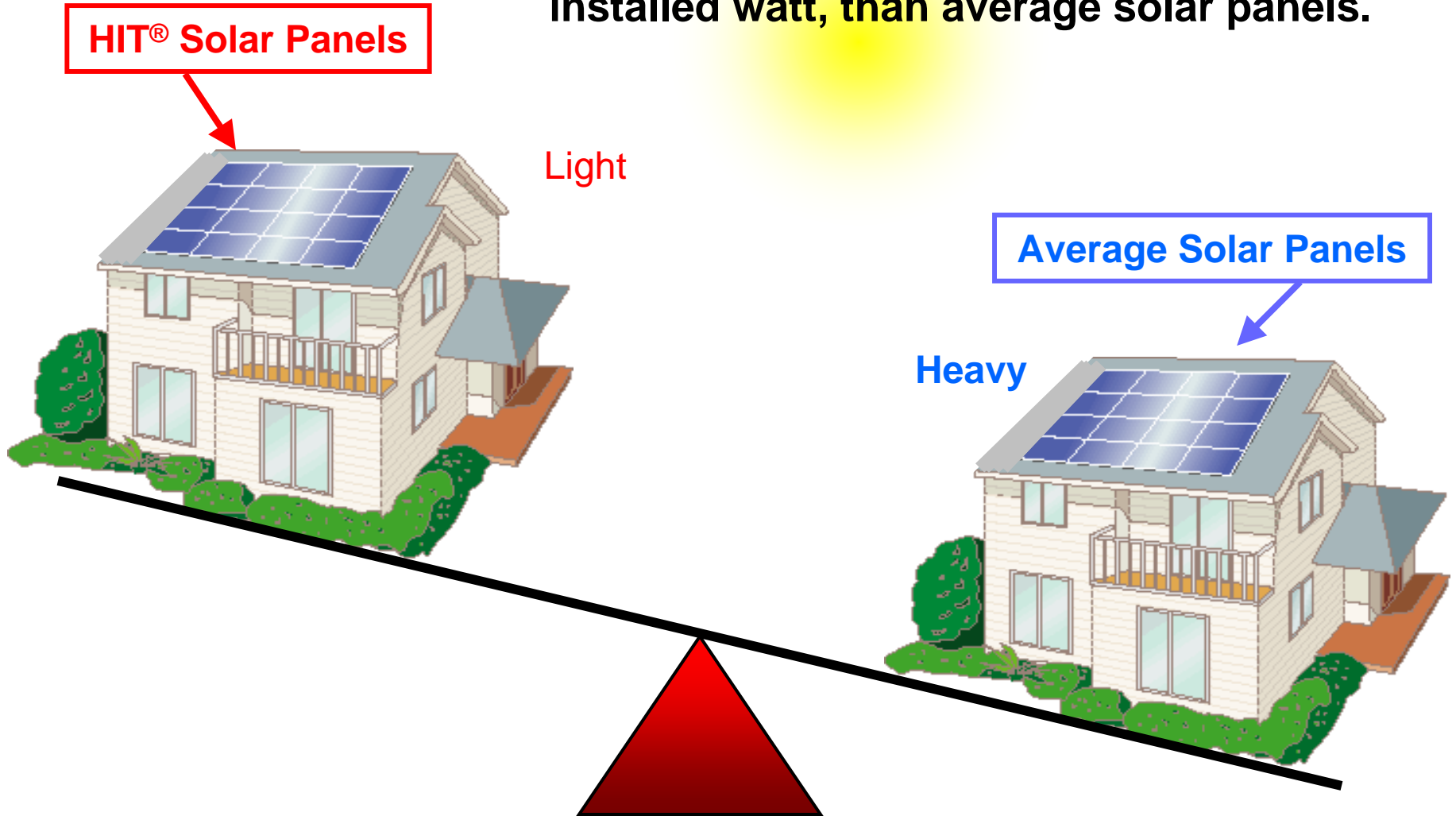
Average Solar Panel Power Capacity = 124.2kW



Producing **more power per sq. foot** means using fewer panels for your home or business.

Or, if you have limited space, use HIT solar panels to **maximize the power capacity** of that space.

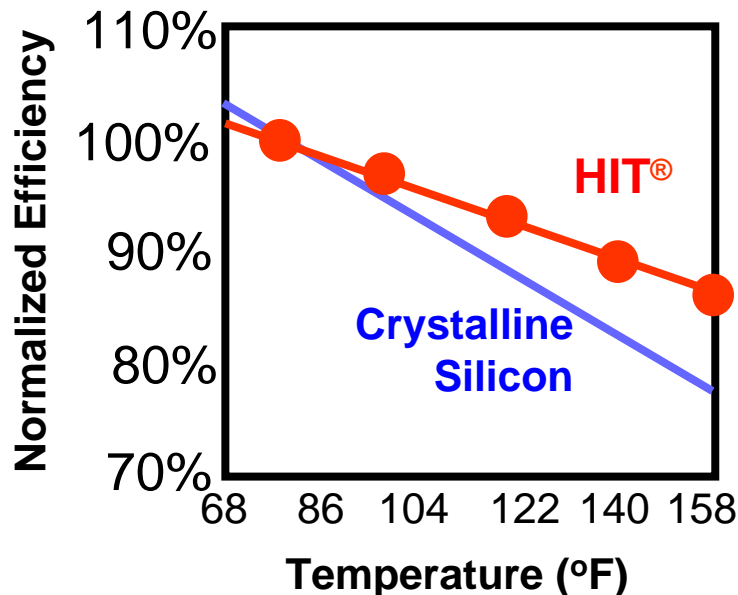
HIT[®] solar panels are **44.4% lighter** per installed watt, than average solar panels.



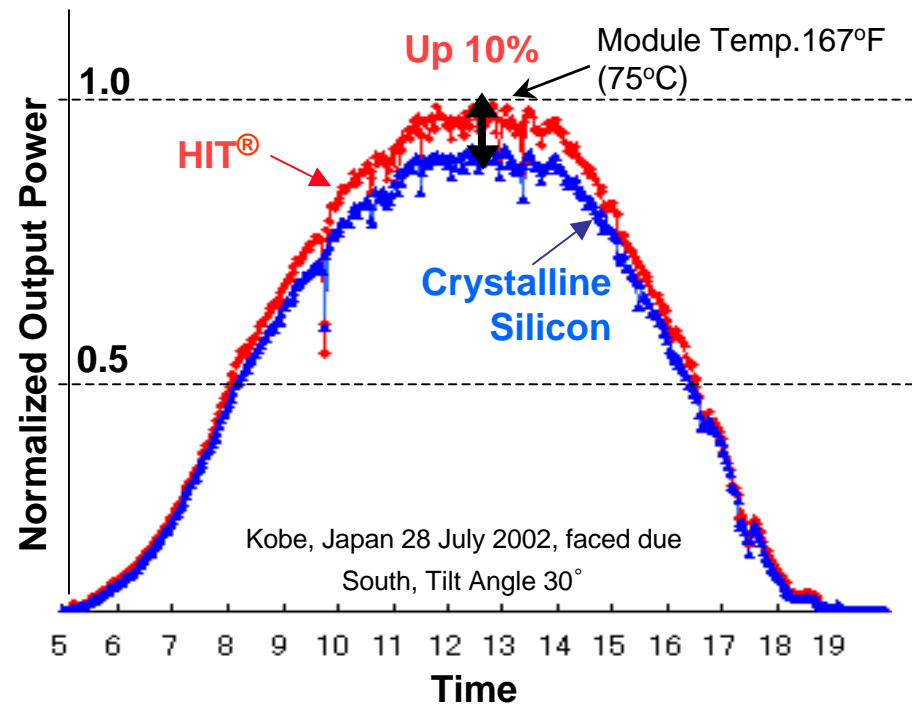
The visible result of a temperature coefficient is the energy generated.

As temperatures rise, the HIT[®] technology allows **HIT panels to produce more electricity** than conventional crystalline silicon solar panels **at the same temperatures, resulting in more kWh.**

Temperature vs. Conversion Efficiency



One Day Actual Power Generation



& Low Environmental Impact



- Factory certifications include:
 - *ISO 9001 (quality), 14001 (environment), 18001 (safety)*
- Product certifications include:
 - *cUL 1703, TÜV, CE, IEC 61215*
- Product quality inspections beyond industry standards:
 - *industry-leading visual, mechanical, electrical, environmental & quality inspections*
- Solar panel output power tested at the *end* of connectors.
- Individual panel power performance results provided for *all* panels.
- Solar panel promise to be *equal to or higher* than its rated power.



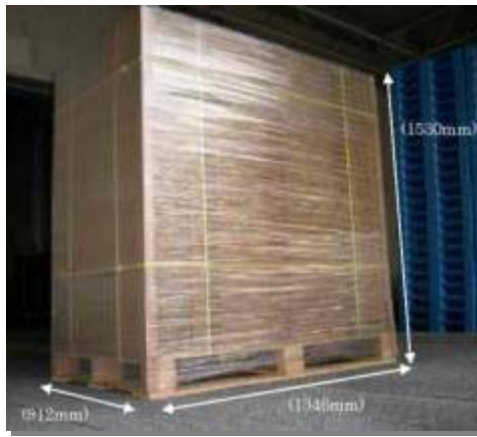
Front View



Back View



Corner View



Pallet View

HIT[®] panels have eco-packaging.

Eco-packaging protects panels during transit and is an environment-friendly way to package HIT panels to reduce cardboard and waste.

- **Sturdy & Protective Packaging**
- **Less Packaging Material**
- **Less Job Site Waste**
- **Less Warehouse Needed for Storage**
- **Less Transit Space Needed**
 - 972 solar panels per 53ft. trailer/truck
- **Reduces Freight, Gasoline, Transit, Disposal, and Storage Costs**

HIT[®] panels come with a Limited Warranty of -0% to +10%.

They will produce their *minimum rated power or more* at the time of purchase.

Individual flash tests are performed on every panel to confirm the power.

You always get the power you pay for with HIT...or more!*

Effective 1 April 2007

Limited Power Output Warranty

Example of HIT 200W Model

	Power Guarantee
At the time of purchase	200 Watts
10 Years	171 Watts
20 Years	152 Watts

Sample of Actual Test Results

Manufactured August 2007

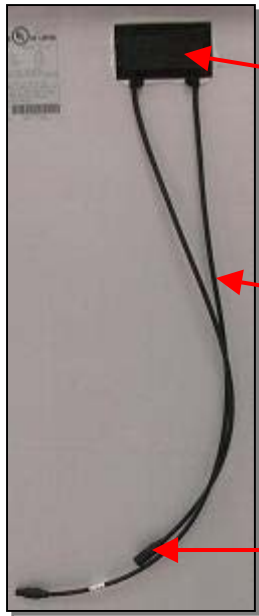
Batch had 126 panels.
Each panel is rated at 200 Watts (P_{max})

Test Results:

Lowest panel = 200.0 Watts
Average Power = 202.0 Watts
Highest panel = 207.8 Watts

**Subject to test-machine tolerances*

HIT = Other Valuable Features



Touch-Safe Junction Box

Pre-attached Lead Wires



Plug-N-Play Connectors

Stainless Steel Top-Down Clips



**Pre-Drilled
Ground Hole**



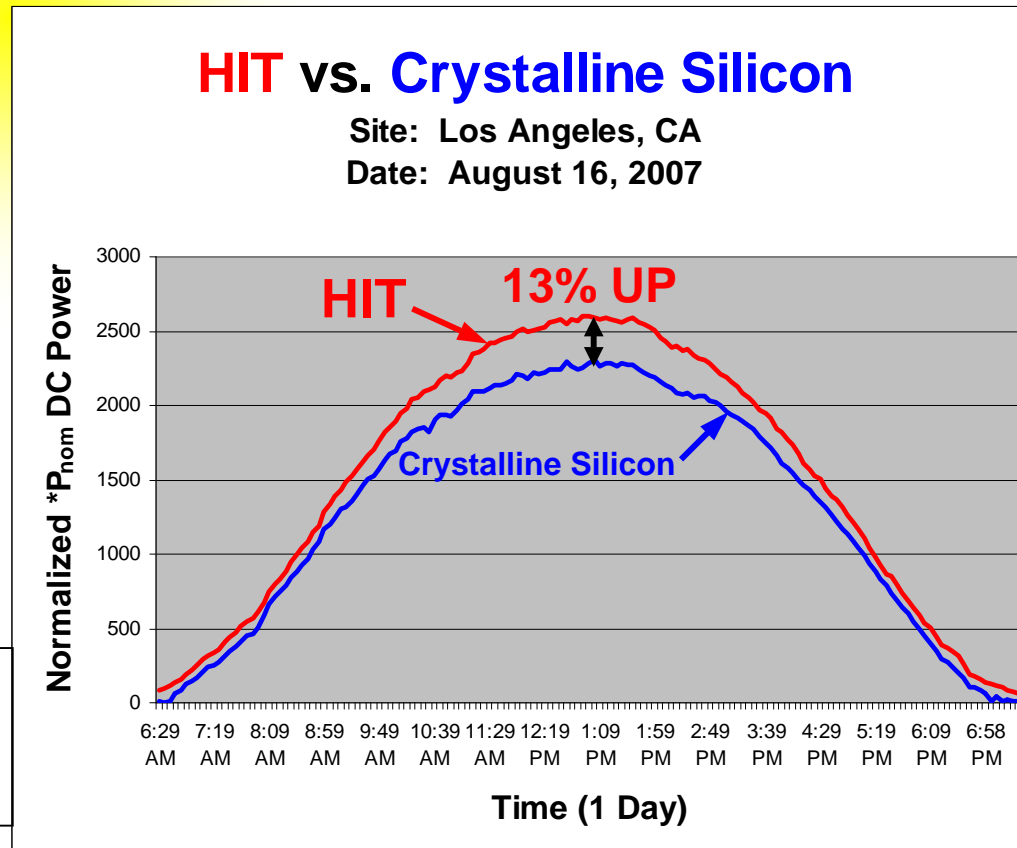
**Panel Barcodes
Inside & Outside**
(for easy inventory tracking)



Unique Attachment Rail

HIT[®] produces more kWh per rated Watt

SANYO's power guarantee, low temperature coefficient, and HIT technology combine to produce more kWh per rated Watt.



Total Yield for the Day = 13.8% Up

Performance Data
Courtesy of John Bloom
Biola University
*Normalized according to STC rated system size

Higher performance is rewarded with higher rebates.



Using **HIT[®]** in areas with REC's or PBI can get you higher rebates.

So, reduce the cost of your system, achieve a faster ROI and enjoy more free money...**courtesy of SANYO HIT.**

PBI vs. Upfront Rebates (EPBB)

- EPBB = Expected Performance Base Buydown.
- A \$2.50 per Watt EPBB upfront rebate is equivalent* to a \$0.39 cent per kWh PBI rebate paid over 5 years.
- With EPBB rebates, if your system performs better than expected, you get nothing.
- With PBI, when your system performs better than expected, you get more money!
- ***HIT panels outperform expectations. Opt into PBI using HIT panels and get more money!***

Depending on how much better your system performs compared to an EPBB calculation, your PBI rebate is equivalent* to an EPBB rebate of:

2% Better = \$2.68/W

5% Better = \$2.75/W

10% Better = \$2.88/W

15% Better = \$3.00/W

* Includes 5% EPBB adjustment and 8% discount rate as of Aug 2007.

HIT Residential Sample Systems



HIT Commercial Sample Systems



Download a specification sheet for more detailed information about individual HIT® models.

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HIT® PHOTOVOLTAIC MODULES

Specification # for Models:
 HP-150EA3, HP-150EA3,
 HP-190EA3, HP-190EA3,
 HP-200EA3, HP-200EA3

**Power Output Range
180~205 Watts
(depends on model)**

**Module Efficiency: 15.3%~17.4%
Cell Efficiency: 17.8%~20.2%**

Proprietary Technology
 SANYO HIT® (heterojunction with intrinsic thin layer) solar cells are hybrids of single crystalline silicon surrounded by ultra-thin amorphous silicon layers.

High Efficiency
 SANYO HIT solar panels are a leader in cell and module efficiency. With models up to 10.2 Watts per sq. foot (37.4% module efficiency) you obtain maximum power within a fixed amount of space. You save costs by using fewer support materials and less time installing. The powerful panels are ideal for grid-connected solar systems, areas with performance based incentives, and renewable energy credits.

Temperature Attributes
 As temperature rise, SANYO HIT solar panels produce more electricity (kWh) than conventional crystalline silicon solar panels at the same temperature.

Unique Structure
 SANYO HIT solar panels have a black anodized aluminum, double-wall frame for extra strength. The panels come pre-equipped with a touch-safe junction box, lead wires, MC² plug-n-play connectors, and unique mounting rails, all of which help to minimize BOS support structure materials, installation time and costs.

Valuable Features
 SANYO HIT solar panels have no moving parts and weigh less than 31 pounds (14kg). The panels are 100% emission and noise free. The panels have a 20-Year Limited Power Output Warranty and a 2-Year Limited Product Workmanship Warranty. Panels are UL 1703 safety rated for wind, hail and fire. Unique eco-packaging minimizes cardboard waste at the job site, and allows storage and transport of panels using less space.

Quality & Ratings
 SANYO silicon wafers are manufactured in the USA, and the panels are assembled in Mexico at an ISO 9001 and 14001 certified factory. All panels undergo inspecting to ensure strict compliance with electrical, mechanical, environmental and visual criteria. SANYO's conservative power ratings for models grant more kWh per rated kW, and assist with accurate predictions of performance and economics.

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All HIP-xxxBA3 Models

Electrical Specifications	180 W	190 W	195 W	195 W	200 W	205 W
Rated Power (P _{max})	W	180	189	190	195	200
Maximum Power Voltage (V _{mp})	V	54.0	54.4	54.5	55.3	55.8
Maximum Power Current (I _{mp})	A	3.33	3.42	3.47	3.53	3.59
Open Circuit Voltage (V _{oc})	V	66.4	67.0	67.5	68.1	68.7
Short-Circuit Current (I _{sc})	A	3.65	3.71	3.75	3.79	3.83
Maximum Power Ratio	W	171.0	176.7	180.5	185.3	190.0
Maximum Voltage (V _{max})	V	600	600	600	600	600
Series Fuse Rating	A	15	15	15	15	15
Temperature Coefficient (P _{max})	%/°C	-0.33	-0.30	-0.30	-0.30	-0.29
Temperature Coefficient (V _{oc})	%/°C	-0.373	-0.168	-0.169	-0.170	-0.172
Temperature Coefficient (I _{sc})	mA/°C	1.10	0.88	0.86	0.87	0.88
Electrical Tolerance	%	+10±5	+10±5	+10±5	+10±5	+10±5
Dimensional Tolerance	%	+10±0	+10±0	+10±0	+10±0	+10±0
Cell Efficiency	%	17.8	18.4	18.8	19.3	19.7
Module Efficiency	%	15.3	15.8	16.1	16.5	17.0
Power per Sq. Foot	W	14.2	14.7	15.0	15.4	15.8

Mechanical Specifications	180 W Models	190 W Models
Number of Joints/ Diodes	1 Bipolar Diode	12 Bipolar Diodes
Module Area (sq.)	12.69 FT ² (1.16m ²)	12.69 FT ² (1.16m ²)
Cell Size (sq.)	30.56 (sq. in.)	30.56 (sq. in.)
Distance bet. 1st & 2nd Rows	5.10x35.29 (130x894.33mm)	5.10x35.29 (130x894.33mm)
Cell Length - Max. (mm)	30.7 (1.21 in.)	30.7 (1.21 in.)
Cell Spacing (mm)	1.0 (0.039 in.)	1.0 (0.039 in.)
Cell Spacing (in.)	0.039 (1.5748 mm)	0.039 (1.5748 mm)
Point to Point Dist. (mm)	53.36x63.26 (2100x2530mm)	53.36x63.26 (2100x2530mm)
Pieces per Full Panel Weight (kg)	20pcs / 111.1 Lbs. (50.4kg)	20pcs / 111.1 Lbs. (50.4kg)
Quantity per 20'x42'x5.7' Container	300pcs / 7.65pcs / 35.2pcs	300pcs / 7.65pcs / 35.2pcs

Operating Conditions & Safety Ratings	
Temperature (°C)	-4 F to 104 F (-20 C to 40 C)
Hail (mm) Impact Velocity	1" (25.4mm) @ 50mph (80km/h)
Fire Code Classification	Class C
Code & Safety Certifications	UL 1703, UL, IEC
Life Expectancy	2 Year Workmanship / 20 Year Power Output
STC: Cell Temp. 25°C, Air S. 3000h/m	Months average use and light of the site.

Dependence on Temperature

Dependence on Irradiance

Dimensions	Unit: mm (inches)
Front	2100 (82.7)
Side	2530 (99.6)
Depth	35 (1.4)

CAUTION! Read the operating instructions carefully before use of these products.

Module specifications and product name may change without notice. ©2007

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<http://us.sanyo.com/industrial/solar/downloads.cfm>

The World's Largest PV Monument

SANYO

Maximum Power: 630kW
Solar Panels: 5,046
CO₂ Reduction: 95 Tons per Year
Weight: 3,000 Metric Tons
Dimensions: 315m x 9m x 37m
Location: Gifu, Japan
Completion: December 2001

**A Symbol of Coexistence
with Our Environment**

