

從全美最大太陽能展 看追日系統及光電光熱的趨勢

國立台北科技大學太陽光電系統安裝分享

主講人：壽明驊

98.12.24

從美國最大太陽能展 追日系統與太陽能發電的新趨勢



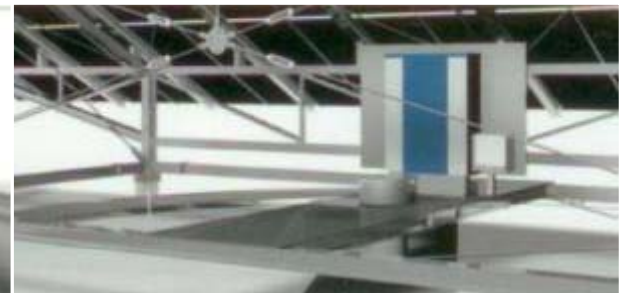
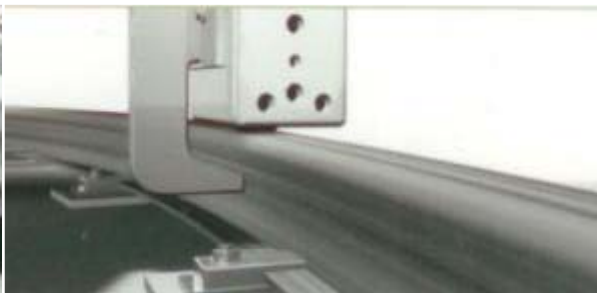
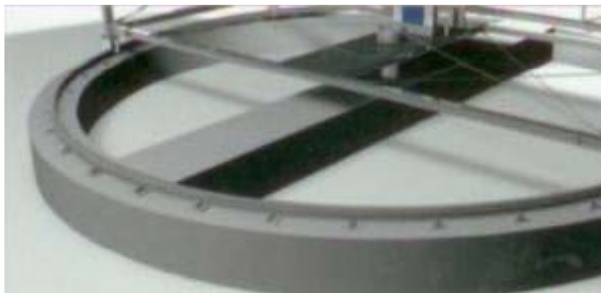
- 追日系統兩極化的發展：極大與極小
- 更多聚焦式產品、太陽熱能運用
- 光電/光熱Hybrid產品問世
- 增加少許設備成本，大幅降低安裝成本
- 功能強化之加值型組件問世

追日系統極大化

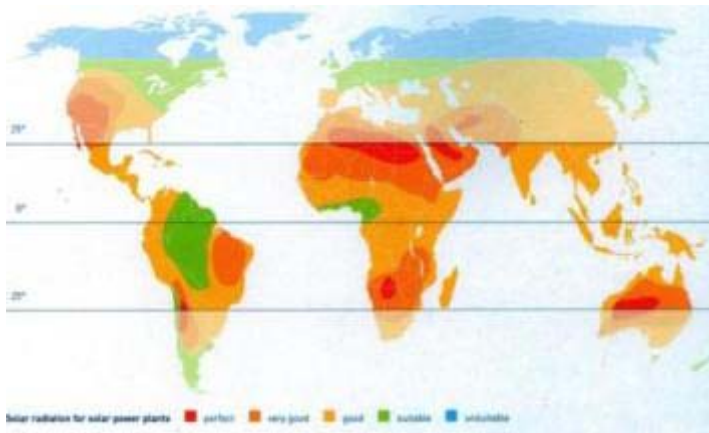


單座追日 $23 * 12$ 公尺 = 54,000Wp, 270Wp模組 * 200片

追日系統極大化



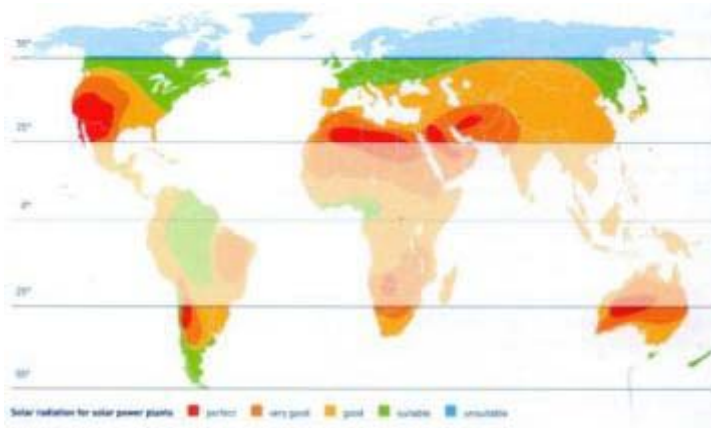
大型追日系統Suncarrier



研發 + 實戰經驗 = 新產品

適用於緯度：25度 – 55度的追日系統，最大單座54,000Wp

大型追日系統Skycarrier



研發 + 實戰經驗 = 新產品

適用於緯度：0度 – 25度的追日系統,最大單座48.000Wp

模組45度放置-應力分析

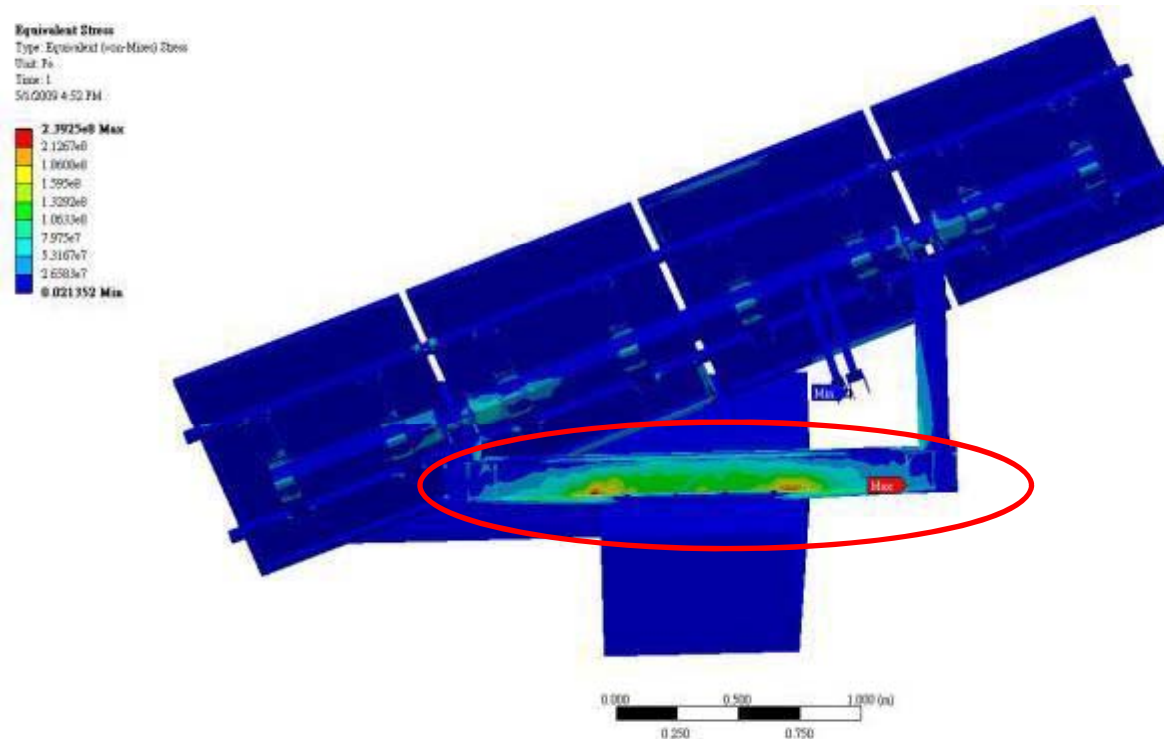
- 條件：模組底面全面承受風速40m/s(壓力為3168Pa)

其計算公式為，風壓 $P=0.6 \times E \times V_0^2 \times ef$

$E=2.75$ 、 ef 為安全係數設定為1.2、 V_0 為風速

- 結果：
 - 東西向的Tracker最大應力值為239.25MPa，最大變形量為4.7cm
 - 南北向的Tracker最大應力值為177.07MPa，最大變形量為1.64mm

模組45度放置-東西向應力圖



應力表讀取方式：
紅色為應力最大
藍色為應力最小

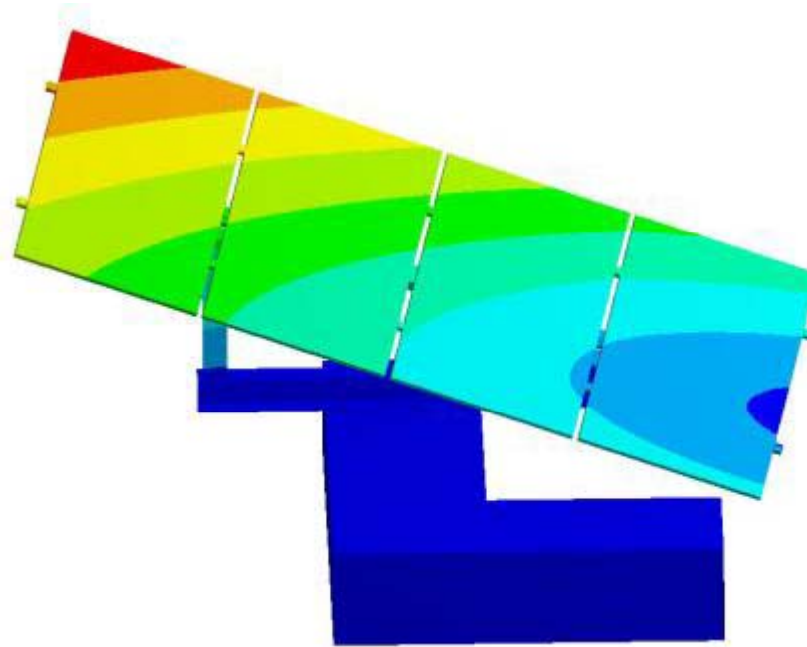
此為整體受力情況，最大應力值發生位置於H型鋼以及H型鋼上的方形補強板，最大應力值為239.25MPa

模組45度放置-東西向變形量圖

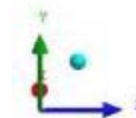


Total Deformation
Type: Total Deformation
Unit: m
Time: 1
5/1/2009 4:55 PM

0.047042 Max
0.042527
0.037211
0.031895
0.026579
0.021263
0.015947
0.010632
0.005318
0 Min



ANSYS
v11.1



0.000 0.500 1.000 1.500 2.000 (m)

此為正視模組的最大變形量示意圖，最大變形量為4.7cm

追日系統極小化



0.6*0.8公尺=70W模組*1



私人庭園追日型路燈

• 追日系統極小化



校園追日型路燈
模組 80W
路燈24W



夜間太陽能板進入接近平放之保護模式

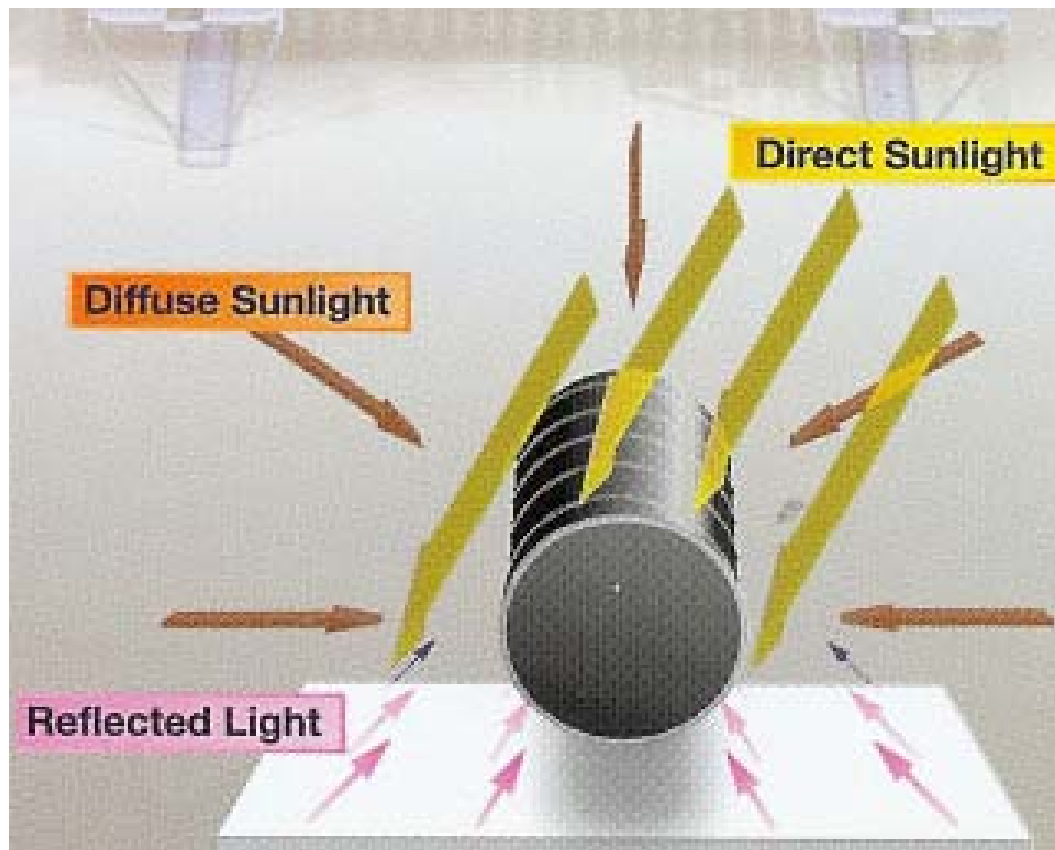
有追日效果的新PV設計

* 這不是真空太陽能熱管



圓筒玻璃管PV模組

內裝可撓式軟質太陽能電池
可吸收來自各方向的陽光



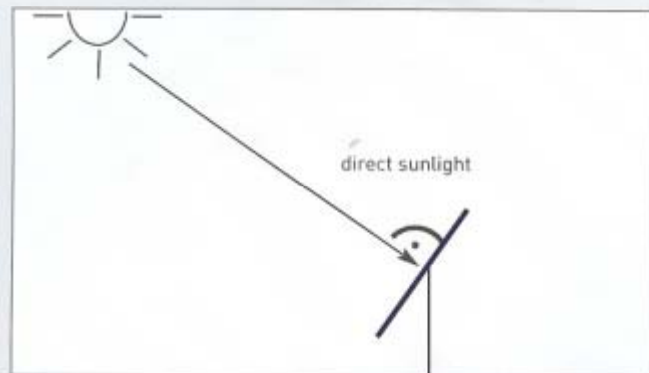
圓筒玻璃管PV模組



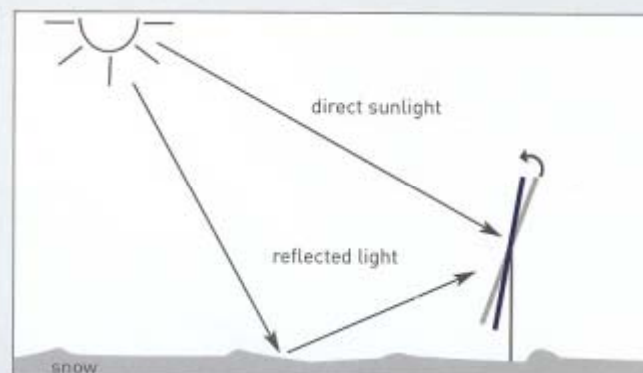
屋頂安裝低風阻＋背面吸收地面反射的陽光

Smart Tracking

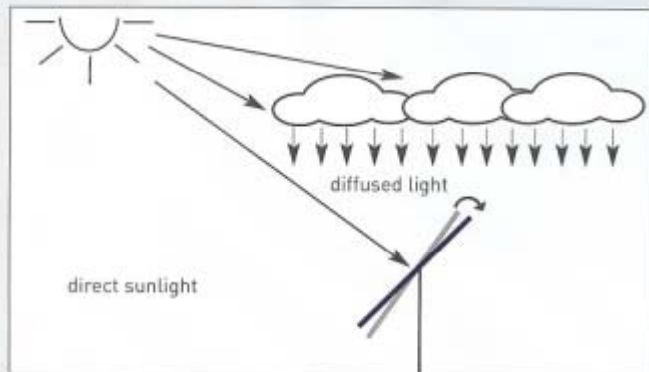
有時候不精確正對太陽位置發電更多



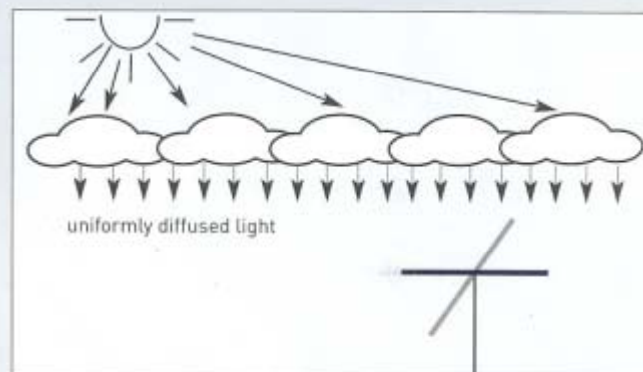
With bright sunshine: The DEGERtraker aligns itself with the brightest point in the sky.



Snow: The DEGERenergie tracking system uses direct light irradiation as well as the energy of reflected light.



Scattered clouds: beside direct solar radiation also diffuse light is used optimally.



Overcast sky: the system detects the brightest spot and directs itself towards the spot.

- 充分利用地面
積雪之反光

在多雲天氣下，追蹤最大透光之天空

聚焦＝追日

聚焦型光能與熱能都需要追日系統

SOLAR TECHNOLOGY LANDSCAPE

Photovoltaic

TRADITIONAL PV



PV cells (usually silicon based) convert solar energy directly into electrical energy

<10kW to 10MW

CPV



Mirrors or lenses focus sunlight onto multi-junction PV cell

100kW to 100MW

DISH ENGINE



Dual axis radial concentrator collector made of curved mirrors tracks and focuses sunlight onto Stirling Engine.*

100kW to >100MW

Solar Thermal

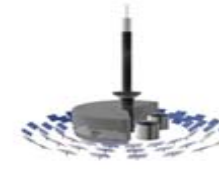
TROUGH



Rows of trough shaped mirrors direct concentrated radiation onto receiver tube

50kW to >100MW

TOWER



Sun tracking mirrors focus sunlight onto a central receiver (usually tower mounted)

500kW to >100MW

FRESNEL REFLECTOR



Similar to trough but uses flat (Fresnel) mirrors to concentrate light

50kW to >100MW

The SES SunCatcher™ Solar Dish-Stirling System Technology is Superior in Efficiency, Reliability and Overall Performance.

Legacy and Pedigree :: The Stirling Dish-Engine

Combined Investment: \$500M

Boeing Aerospace & Defense
Dish Engineering Control Componentry

Solar Pioneers, Inc.

1970

Ford Aerospace Advanced
Development Operations

1980

McDonnell-Douglas
Aerospace & Defense

1990

Stirling Energy Systems, Inc. (SES)
1996 - Present

2000

2010

NTR
Long-term Investment



多家廠商展出HCPV小型化產品



1200倍聚焦，單一模組270W

多家廠商展出HCPV小型化產品



1200倍聚焦，單一模組270W

更多聚焦產品

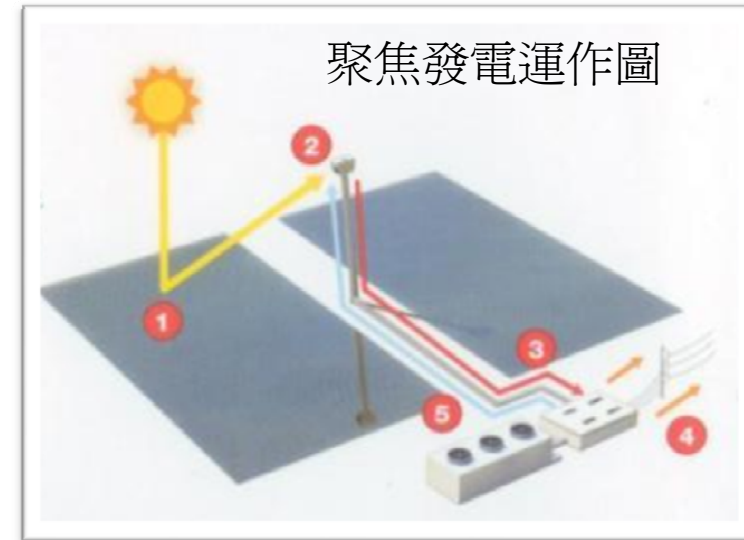


更多聚焦式產品

- 雙太陽塔、每座發電2.5MW
- 佔地20英畝
- 24,000組雙軸追日鏡
- 10,000 SUN
- 蒸汽溫度可達攝氏440度
- 供應2,000家庭電力



更多聚焦產品

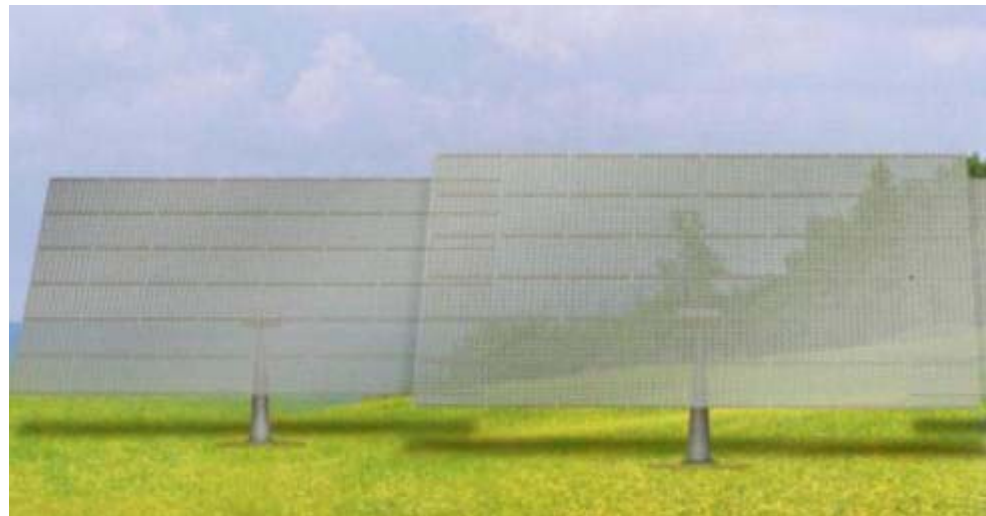
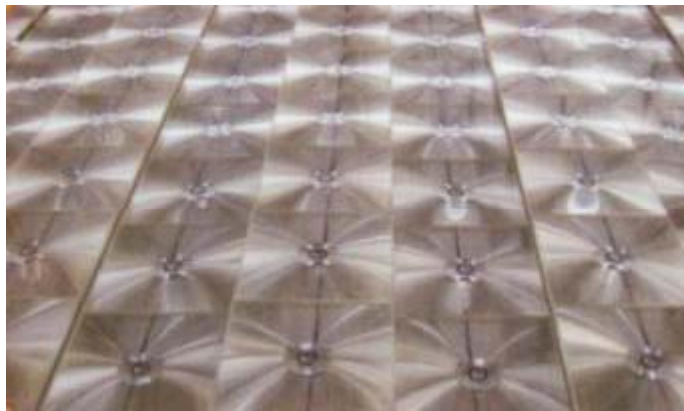




多聚焦產品



- 世界第一：無外金屬框之導光式超薄型HCPV模組
- 1400倍聚焦



大型史特靈引擎聚焦發電系統

for efficiency improvement

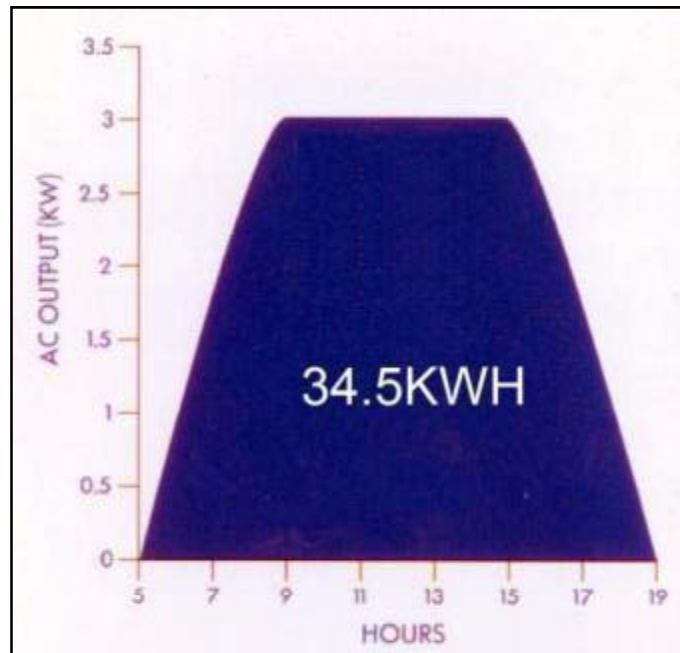


大型史特靈引擎聚焦發電系統

- 每座系統為25KW
- Imperial Valley Solar Two Project
- Phase I: 300MW
- Phase II: 450MW
- 30,000座大型追日系統



中型史特靈引擎聚焦發電系統



每座追日系統為3Kw



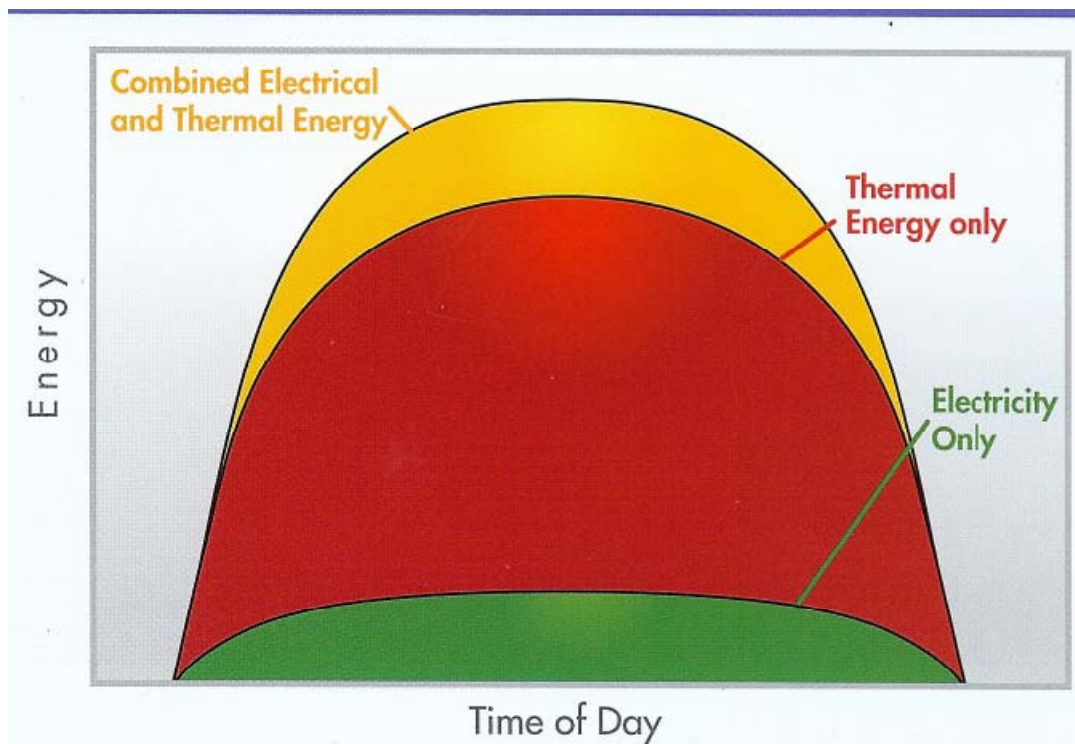
聚焦太陽熱能運用



光電/光熱Hybrid產品



CPVT：聚焦式光電＋光熱



- 20倍聚焦220W光電＋65度C熱水＝70％整體效率
- 大幅超越一般矽晶PV發電系統的12％整體效率

大型光熱系統已經大規模裝設



The Concentrated Solar Power (CSP) plant Nevada Solar I was installed close to Boulder City, USA, in June 2007. It has an output of 64 MW. With an area of 7.4 million m² it is as large as 212 football fields.

- 2007年6月加州的Nevada Solar I 開始運轉發電，容量64MW

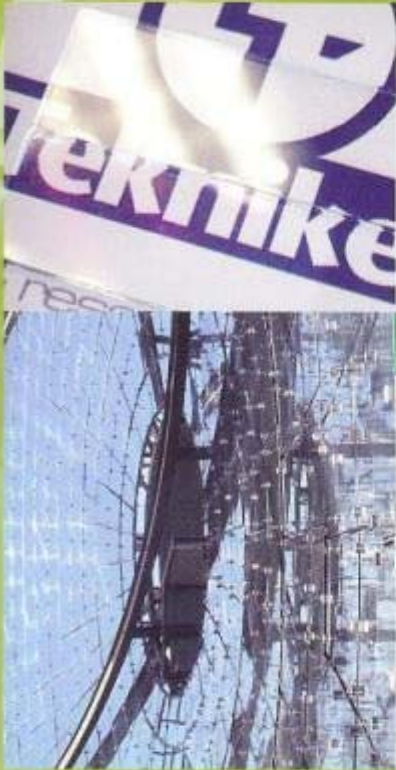
鏡面聚焦系統＋工業級高溫真空熱管

for efficiency improvement

- 鏡面鋁薄板
- 80倍聚焦
- 每一列長115公尺
- 面積750平方米鏡面
- 395度C熱礦物油
- 15-45分鐘儲熱
- 最經濟有效減碳方法
- 現有蒸汽渦輪電廠之輔助熱源
- 運用已有之蒸汽渦輪發電機以及現有之輸電設施。
- 水冷式系統效率23%
- 氣冷式系統效率14%



奈米薄膜技術與聚焦光熱緊密相連



SURFACES AND COATINGS

Specialists in developing coatings and surface treatments for their application to machinery, automotive, sensorial, building and other parts and components.

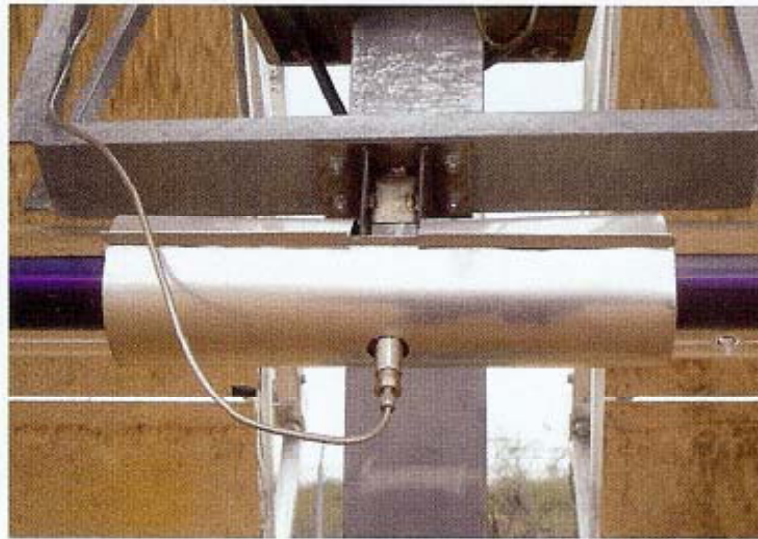
TECHNOLOGIES

- Physical Vapour Deposition (PVD) by sputtering or Arc 多弧或濺鍍PVD
- Solgel and other chemical Techniques for surfaces 凝膠法
- Texturing by UV- Lithography

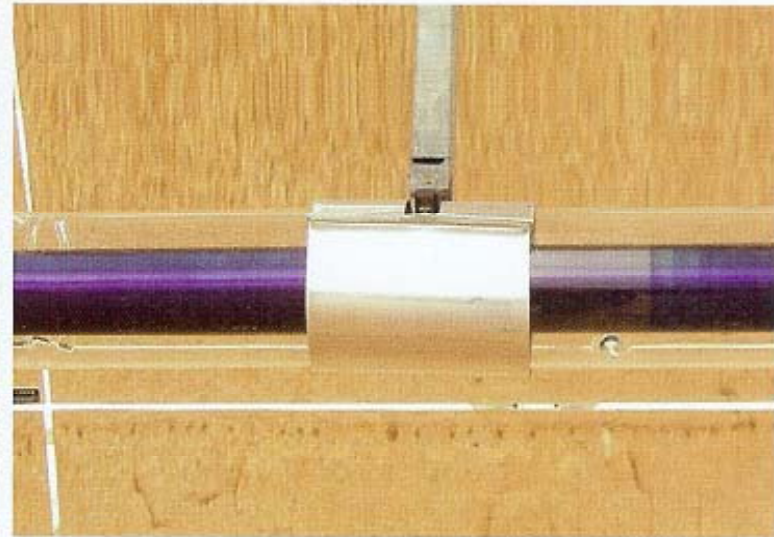
SOLAR APPLICATIONS

- Selective surfaces 選擇性吸收鍍膜
- Antireflecting surfaces 抗反射鍍膜
- Hydrophilic, hydrophobic or biocide coatings for self-cleaning surfaces 親水性或疏水性鍍膜
- Highly reflective surfaces 高反射性鍍膜
- Photocatalytic coatings 光觸媒表面塗裝

能耐400度C的高溫鍍膜



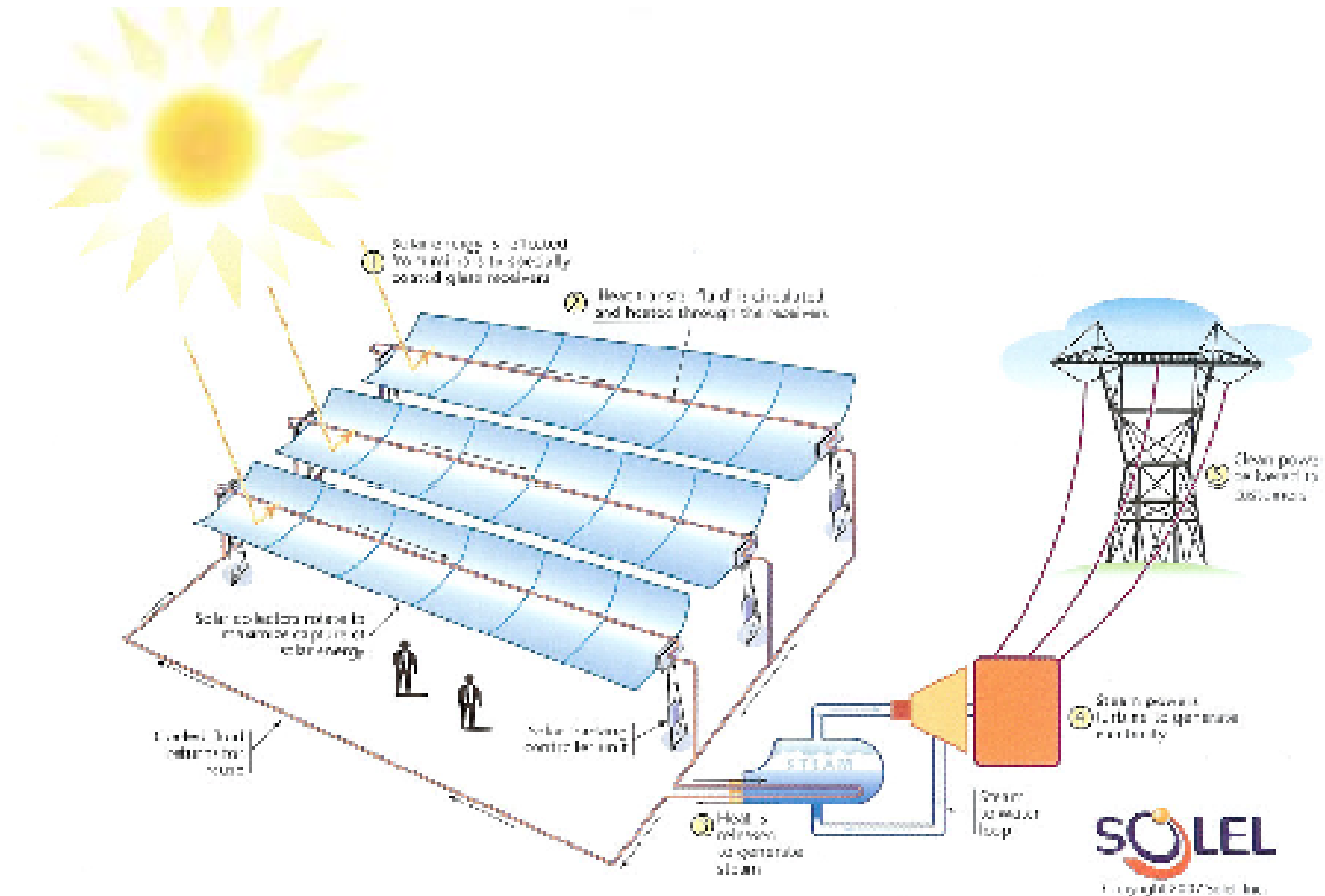
HCE Thermcwell Connection



HCE to FCE Connection

- 不鏽鋼鐵管表面之選擇性吸收鍍膜
- 玻璃管表面之抗反射鍍膜
- 反射鏡面之親水性自潔鍍膜

槽式聚焦太陽光電系統圖

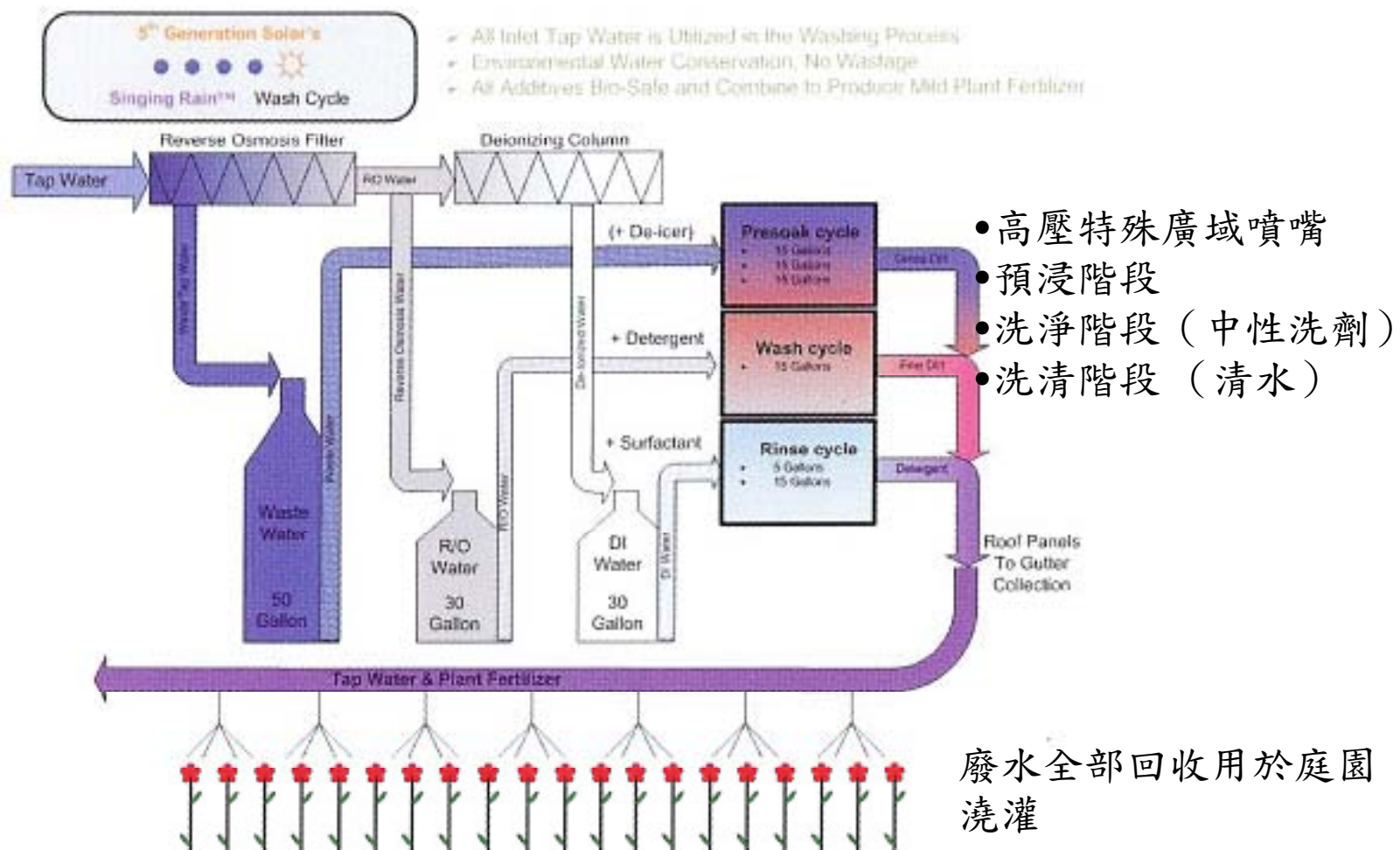


清潔面板新方法

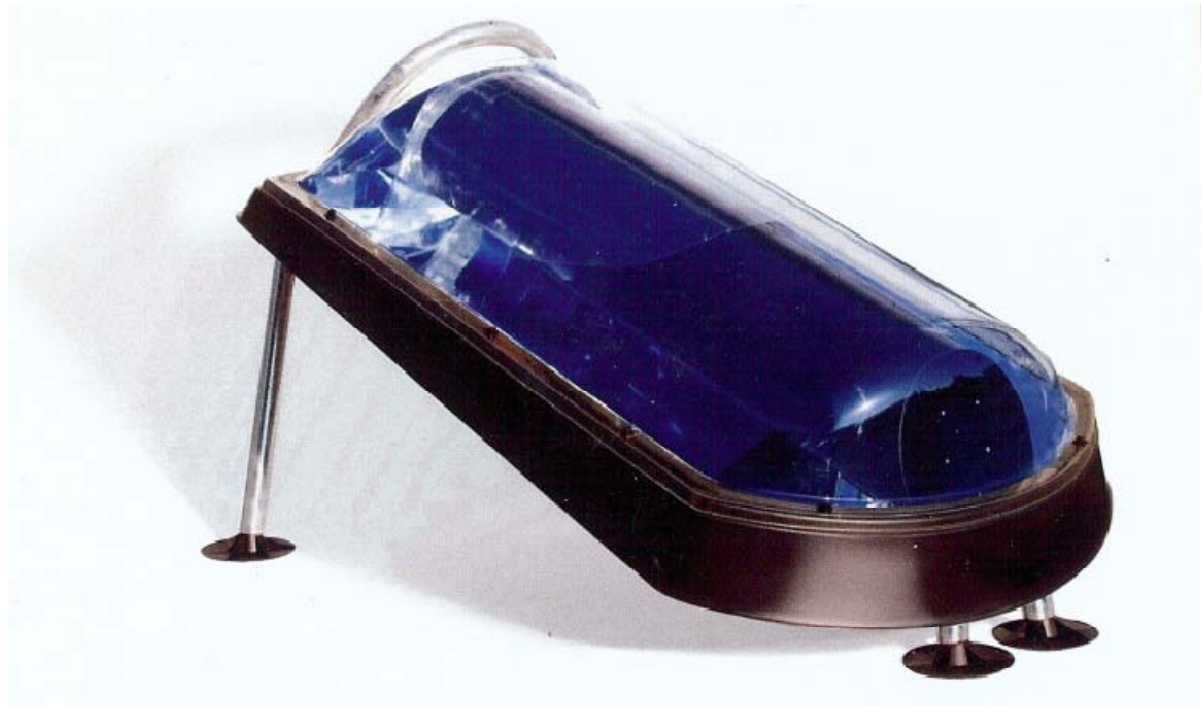
- 傳統清洗方法



清潔面版新方法



濺鍍高吸收膜之造型太陽能熱水器



設備簡化利於安裝 *for efficiency improvement*

- 歐美人工貴，總安裝成本 = 設備成本
- 預先裝好的MicroInverter以及框架節省大量人工



Micro Inverter 問世

- 每片模組後面都有一小型Inverter
- 每一模組都有MPPT，效率高
- 120/240VAC，拉線簡單
- 可追蹤記錄每個模組發電狀況
- 增加5-25%產電量



增加設備成本，降低安裝成本

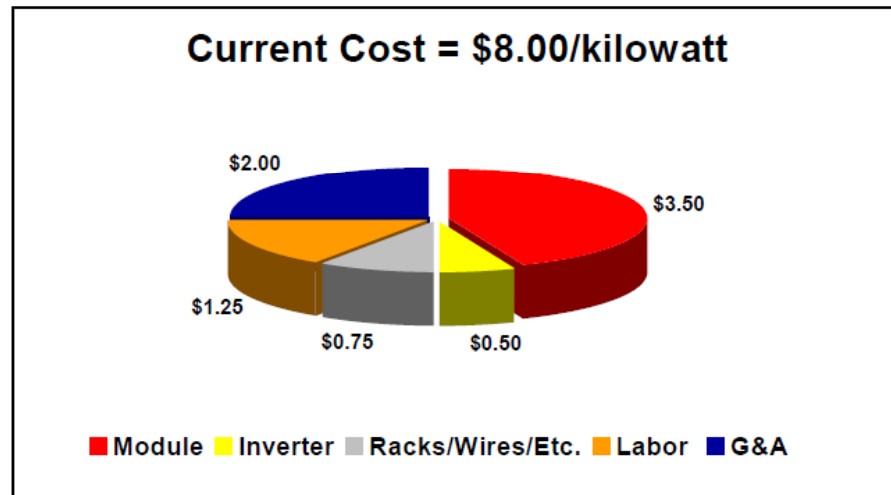


Figure 1: This chart shows the consumer paying \$8.00 per watt, the installer paying a total of \$6.00 per watt in the form of panels, inverters, racks and wires.

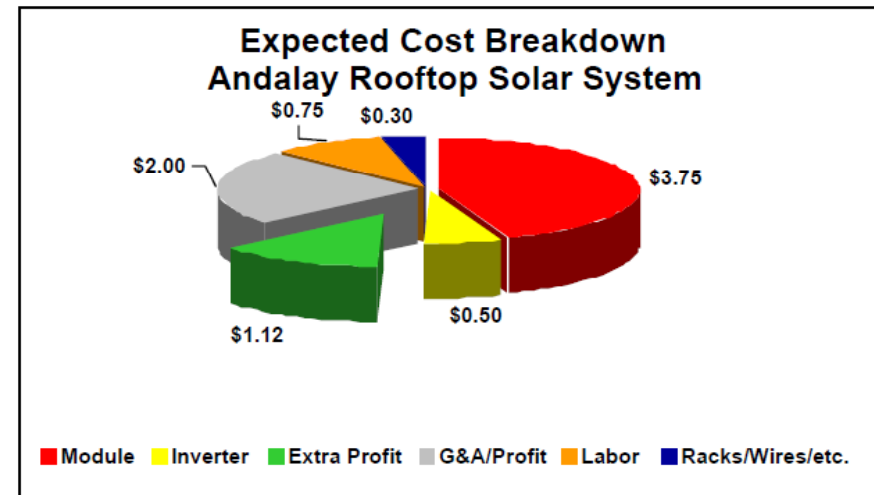


Figure 2: This chart shows the consumer paying \$8.42 per watt, the installer paying a total of \$5.30 per watt for an Andalay system, leaving \$3.12 to cover G&A plus profit, which equates to an expected profit increase of \$1.12 per watt compared to the non-Andalay case.

節省安裝工時另一例

- 加強模組鋁框結構，能降低模組架的成本以及安裝工時



針對被遮陰單一模組而設計之MPPT



針對被遮陰單一模組設計之MPPT *for efficiency improvement*

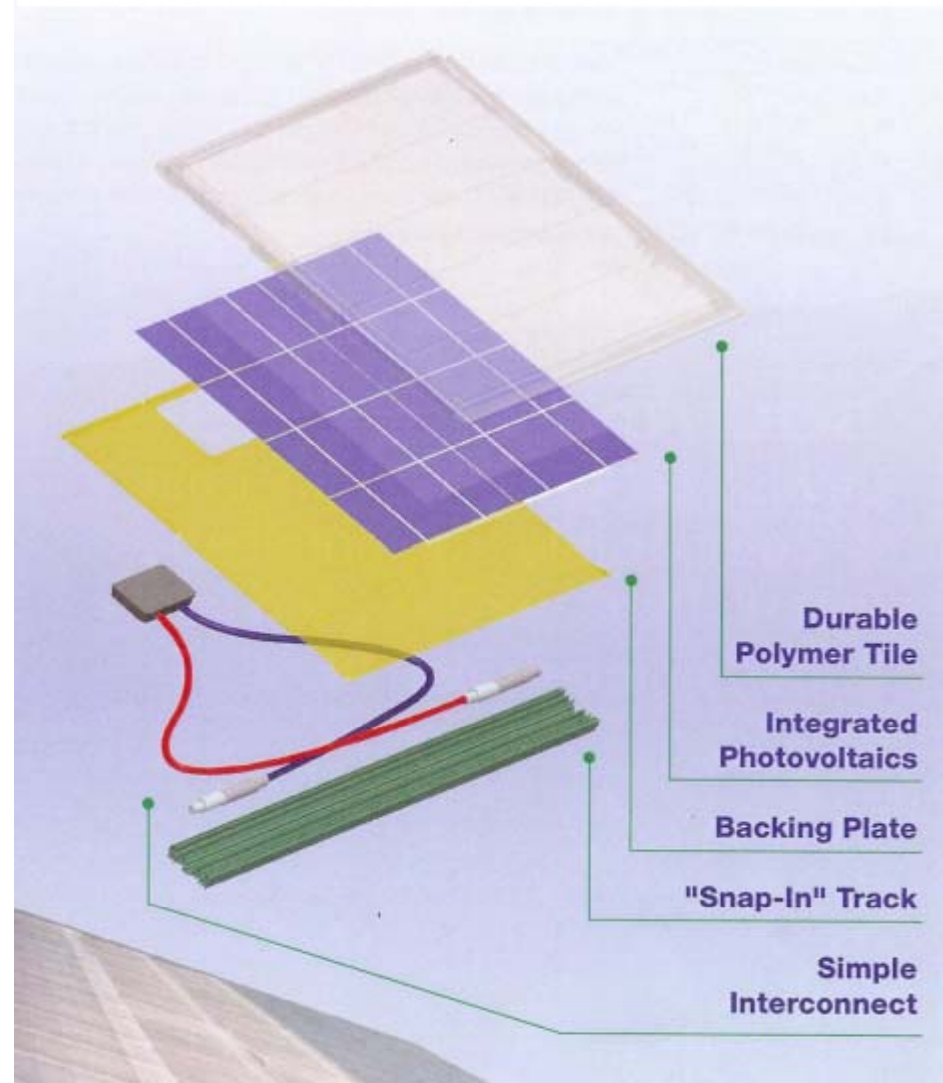
- >98% efficiency
- 250W (Pmax)
- 44VDC Max
- 9A DC Max
- 安裝在被遮陰的個別模組背面，能減少因個別模組被遮陰而造成之整串模組發電效率下降損失的50%



用太陽屋瓦取代原有屋瓦，省錢又省工



卡筭拼裝式BIPV屋瓦，取代原有屋瓦



移動式太陽能發電車



野外和緊急發電使用

綠源科技— *for efficiency improvement*

- 專業團隊為您量測裝置大小、協助申請補助款、完備服務流程與售後服務
- 服務專線：**02-2641-6567**
- <http://www.green-source.com.tw>



for efficiency improvement

Thank you for your attention!

