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UNIQUE SOLAR ENERGY APPLICATIONS

CAR PARKS



BIPV ROOFING

(Building Intergrated Photo Voltaics)



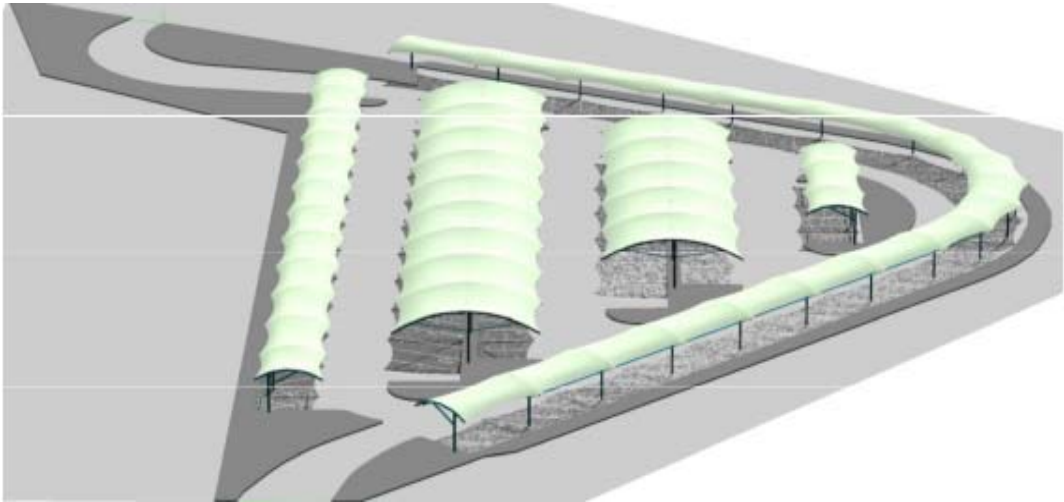
SOLAR LAND FILLS



Car Parks with Flexible Solar Panels



Car Parks



BIPV Roofing system



PROJECT SUMMARY

Customer TESCO Fresh & Easy Neighbourhood Market Distribution Centre

Location: Riverside, California

Completion Date: March 2008

System Components: 2,456 ea of S1816G1 Solar Panels SatCon AE-225-60-PVA Inverters

System Peak Capacity: 2,004.096 kW (DC STC)

Solution:

BIPV thin-film, lightweight and building intergrated solar panels were are perfect solution for the 820,400 sq ft distribution centre. At 500,000 sq ft the solar panel installation is the size of 5 football fields and is considered to be one of the largest roof mounted solar installations in North America. Rated at 2,693 MWh per annum, the system is currently generating up to 50% of the distribution centre's power requirements on a daily basis. Tesco's Fresh & Easy is so proud of its green roof that it provides a live feed of the solar panel's energy output that can be viewed 24 hours a day on its website at www.freshandeasy.com

Benefits:

To date the system has provided more than 5,800 MWh of energy-enough to power more than 830 typical homes, 11,600 TV's, 5,823 refrigerators or 27,730 light bulbs.

The Solar powered roof generates up to 50% of the building's power requirements on a daily basis.

Tesco is saving its community from more than 5,000 tons of CO₂ emissions each year.



SOLAR FARM: Ground mounted systems for landfill

Lunghezza

1 MW

Rome, Italy



Paramount Farms

1.1 MW

Lost Hills, California, USA



Designed to accommodate the energy and topographical needs of the customer, our ground mounted system for landfills provide a means to generate electricity while accommodating the ever changing land mass of a land fill during the renaturing process due to its on going decomposition. This closes a 20-25 year gap between the last rubbish added and the final turn over to conventional usage.

Combining flexible photovoltaic modules with state-of-the-art heavy duty membranes SKYShades offer solar energy solutions for "new" unsettled and sloped landfills.

While conventional rigid glass panels can only be installed after a significant period of post closure subsidence the unbreakable and flexible SOLAR PV-laminates allow for topographically instability allowing deployment more than two decades earlier.

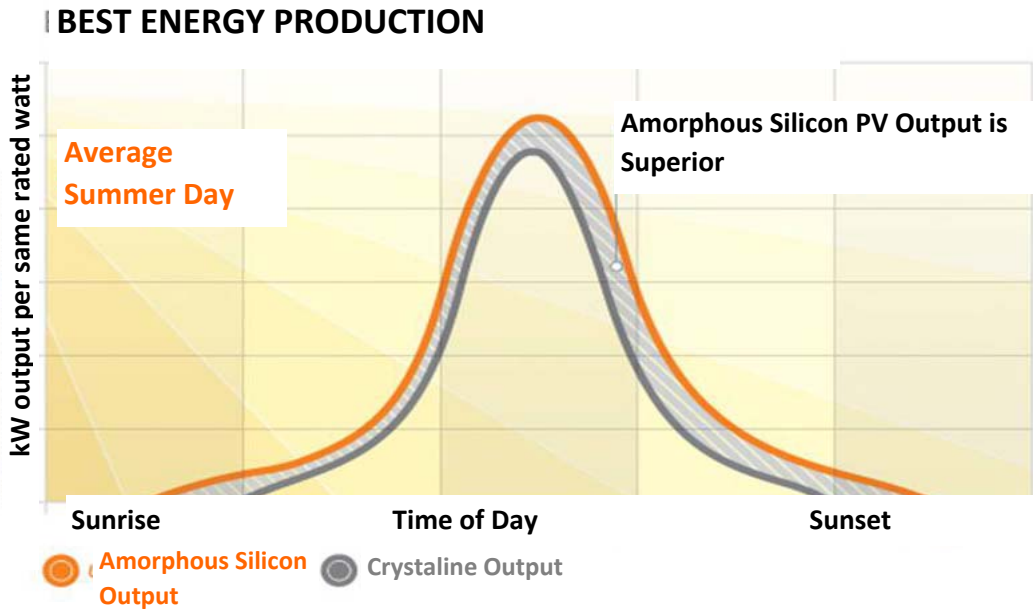
No extra cost for racking systems, rails and ballast are required instead-combining SOLAR PV-laminates with heavy duty membranes results in a linear solution commonly known to the waste industry.

The SolarLandfill linear technology allows to combine and enhance functions:

- 1: Prevention of landslides / soil erosion
- 2: Cleaner water runoff, enhanced water table sequestration and prevention of ground water contamination
- 3: Better leachate control.
- 4: Protection against gas escape, while not imposing any restrictions on gas extraction for energy generation or flaring.

Superior Energy Output of Amorphous Silicon

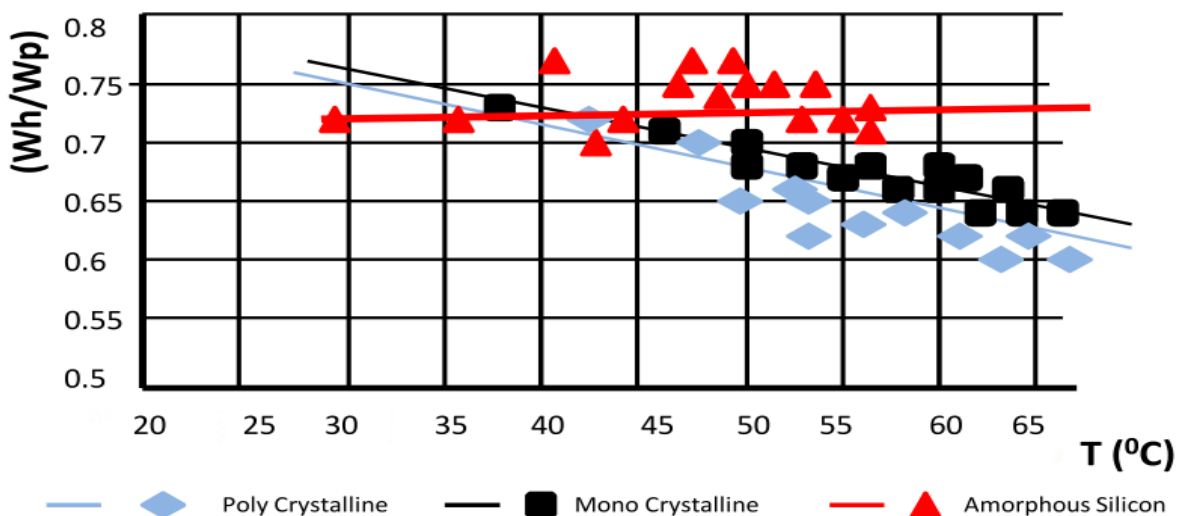
Amorphous Silicon out performs conventional solar by converting a wider spectrum of the Sun's light into a Triple Junction Light Spectrum to produce more energy.



Amorphous Silicon performs better under Higher Temperature conditions

Amorphous Silicon also performs better at higher temperatures whereas output of crystalline arrays decreases by 0.5% per degree Celcius over the standard test conditions temperature of 25° C. Amorphous silicon is one of a number of thin film technologies. This type of solar cell can be applied as a film to low cost substrates such as glass or plastic in a variety of module sizes. Advantages of thin film cells include easier deposition and assembly, low cost of substrates or building materials, ease of production and suitability to large applications.

Yield in function of module temperature; Urbino, Central Italy (2003 – 2004)



Source: University of Urbino, Italy

Specifications:

Electrical Characteristics:

Standard Test Conditions (STC)

1000 W/m², AM 1.5, 25C⁰ Cell Temperature

Model Number	PVL 144
Material	Amorphous Silicon
Max Power	144W
Rated Power	144W
Rated Voltage	33V
Rated Current	4.36A
Efficiency	8.20%



Construction Characteristics:

Dimensions:	Length 5486 mm, Width 394mm, Depth 4mm, 16mm including potted terminal housing assembly.
Weight:	7.7kgs
Output Cables:	4mm ² cable with weatherproof DC-rated quick-connect terminals 560mm length.
Bypass Diodes:	Connected across every solar cell.
Encapsulation:	Durable ETFE high light transmissive polymer.
Adhesive:	Ethylene propylene co-polymer adhesive sealant with microbial inhibitor.
Cell Type:	22 triple junction amorphous silicon solar cells 356 x
Features:	Low light and high temperature performance, more kW hrs, no glass, lightweight, durable, shadow tolerant. ETFE non stick surface for minimal maintenance.

Key Attributes:

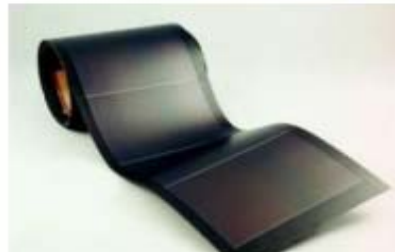
Bypass Diodes	Connected across every solar cell.
Wind Rating	300 kph.
Tilt	Minimum 3° tilt.
Energy Yield	10 - 20% more than crystalline.
Cell Type	22 triple junction amorphous silicon solar cells 356mm x 239mm connected in series.
Roof Penetration	None.
Roof Attachment	Various non-penetrating attachment mechanisms depending on roof type.
Warranty	Limited power output warranty: 92% at 10 yrs; 84% at 20 yrs; 80% at 25 yrs (or minimum power). 5 yr limited product warranty.

Notes:

- 1 During the first 8-10 weeks of operation, electrical output exceeds specified ratings. Power output maybe higher by 11% and operating current maybe higher by 4%.
Electrical specifications are based on measurements performed at Standard Test
- 2 Conditions of 1000Wm² irradiance. Air Mass 1.5 and cell temperture of 250^c after stablisation.
- 3 Actual performance may vary up to 10% from rated power due to low temperture operation, spectral and other related effects. Maximum system open circuit voltage not to exceed 600 VDC per UL 1000 VDC per TUV Rhienland.
- 4 Specifications subject to change without notice.
In the solar business today, system purchases are made on a dollar-per-watt basis. But, the return on investment (ROI) or payback period is determined by the amount of electricity, in kWh, the system produces. Third party testing, in real
- 5 world conditons, shows the long-term and performance of this product produces more energy for your purchased watt, and, therefore, provides the best return on investment.
- 6 Amorphous Silicon is shade tolerant, hail resistant and is tolerant to high temperatures, producing superior outcomes and achieving better ROI.



Competition Today



Thin-film Flexible Solar Today

Energy Yield (kwh kW)	1300-1500	1600+
Weight kgs/ m ²	8.2 -13.66	3.6
Conversion Efficiency %	9 - 22	8.2
System Price (\$/Watt)	\$5.50 - \$6.80	\$5.20-\$6.20
LCOE (\$/kwh)	\$0.20 - \$0.27	\$0.21

High Performance

Thin-film cells
flexible - non-glass - lightweight

Robust and Durable

corrosion-resistant, self cleaning

Easy to Install

mounted directly onto profiled sheeting, no substructure



STRUCTURAL ADVANTAGES:

Engineering Advantages

Easy assembly without roof penetration maintains the integrity of the roofing material and its respective roofing guarantees.

The low visual impact, its direct fixation to the roofing material paired with a glass-free encapsulation make the Solar PV laminates impervious to vandalism or theft.



System Advantages

The textured module surface has a self-cleaning effect and by being anti-glare increases light absorption. While this attribute increases energy yield it also makes the Solar PV laminates a perfect choice for reflection-sensitive applications such as at airports.

Our unique PV-laminates offer cost advantages inherent in the system due to

- 1 Reduce installation time
- 2 reduced logistics expenditure
- 3 reduced balance of system (BoS) costs

Particularly attractive is the fact that no additional substructure is required for mounting, reducing material and handling requirements.

Higher Return on Investment

The advantage described combined with the higher energy yield of the shadow-and-heat-tolerant triple-junction cell technology ensure a high rate of return on the investment over the systems lifetime.

Three Step Performance Warranty

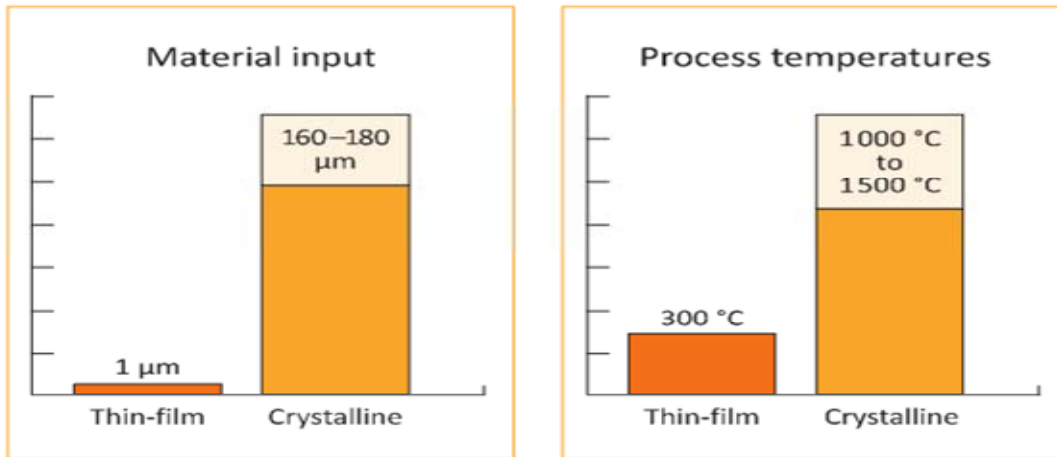
Our confidence in the long term performance of our products allows us to offer a three-step performance warranty, which guarantees that the Solar modules will produce:

- 1: 92% of minimum power after 10 yrs
- 2: 84% of minimum power after 20 years
- 3: 80% of minimum power after 25 years



Environmentally Friendly Production

Thin-film Solar PV laminates are produced under efficient, ecologically friendly production parameters with lower material and energy input compared to conventional crystalline silicon modules.



UNIQUE PRODUCT ATTRIBUTES



Lightweight

These PV laminates are extremely lightweight with only 3.6 kg/m².



Easy to Install

Our PV laminates are easy to install using common roofing techniques. PV and roofing can be installed at the same time.



Flexible

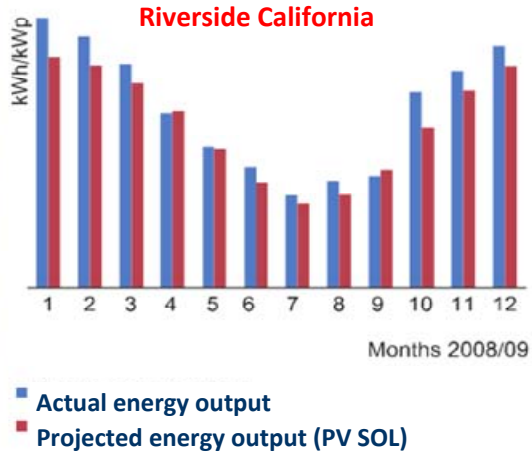
Our PV laminates are flexible, offering freedom of design to architects and they can also conform to curved surfaces.



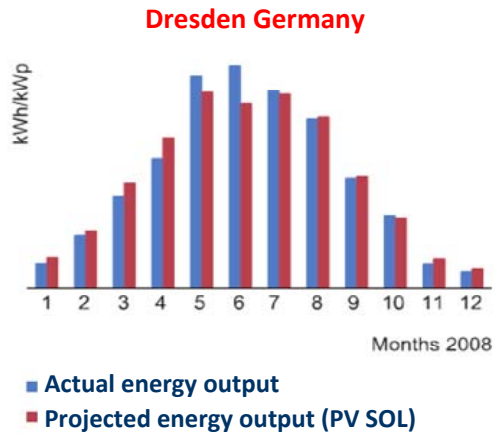
Durable

Glass-free, encapsulated in UV stabilized, weather resistant polymers, our PV laminates are resistant to wind and hail.

Reliable Estimates in Different Conditions:



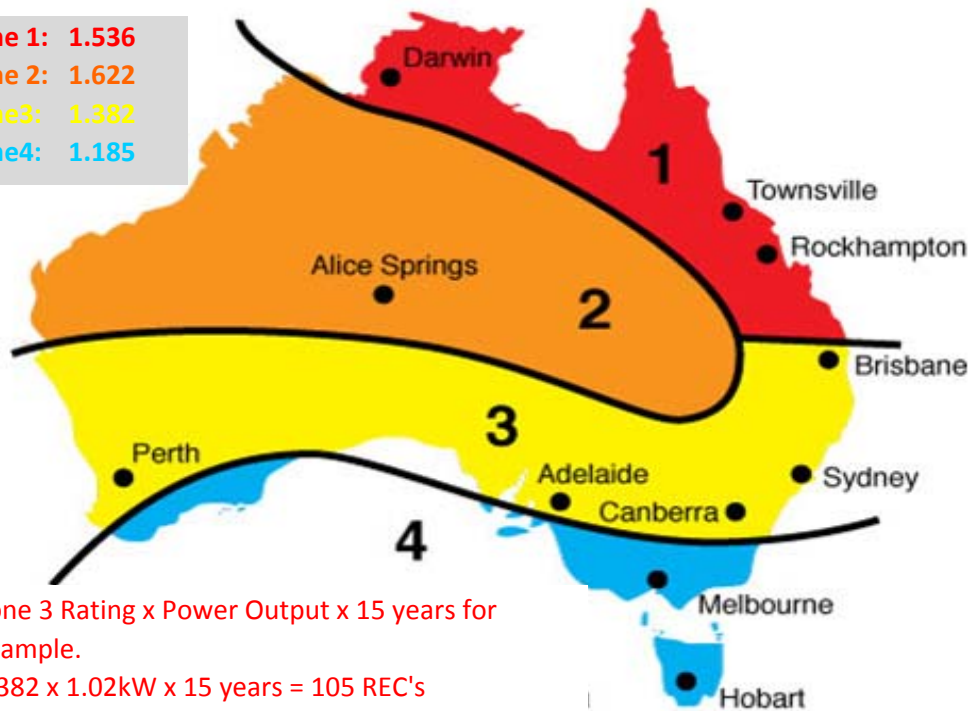
Irradiance 1999 kWh/m² Size 2 MWp Tilt angle: 3° Installation 2008
 Specific annual energy yield: Predicted: 1355 kWhrs Measured: 1488 kWhrs



Irradiance 987 kWh/m² Size 786 kWp/m² Tilt angle: 3° Installation 2007
 Specific annual energy yield: Predicted: 861 kWhrs Measured: 864 kWhrs

Solar Radiation For Identifying REC's

- Zone 1: 1.536
- Zone 2: 1.622
- Zone3: 1.382
- Zone4: 1.185



Zone 3 Rating x Power Output x 15 years for example.
 $1.382 \times 1.02\text{kW} \times 15 \text{ years} = 105 \text{ REC's}$
 Based on a 1.02 kW system with Solar credits.

POSTCODE RANGE

From	To	Zone	From	To	Zone	From	To	Zone
200	299	3	3750	3898	4	5231	5261	3
800	862	1	3900	3900	3	5262	5263	4
870	872	2	3902	3996	4	5264	5270	3
880	909	1	4000	4419	3	5271	5291	4
1001	2914	3	4420	4420	1	5301	6256	3
3000	3381	4	4421	4428	3	6258	6262	4
3384	3384	3	4454	4454	1	6271	6318	3
3385	3387	4	4455	4468	3	6320	6338	4
3388	3396	3	4470	4475	2	6341	6141	3
3399	3413	4	4477	4477	1	6343	6348	4
3414	3424	3	4478	4482	2	6350	6353	3
3427	3451	4	4486	4488	3	6355	6356	3
3453	3453	3	4489	4493	2	6357	6395	3
3458	3462	3	4494	4615	3	6396	6398	4
3463	3465	4	4620	4724	1	6401	6439	3
3467	3469	4	4725	4725	2	6440	6440	2
3472	3520	3	4726	4726	1	6441	6444	3
3521	3522	4	4727	4731	2	6445	6450	4
3523	3649	3	4732	4733	1	6460	6640	3
3658	3658	4	4735	4736	2	6642	6725	2
3659	3660	3	4737	4824	1	6726	6743	1
3661	3709	3	4825	4829	2	6751	6799	2
3662	3709	3	4830	4891	1	6800	6997	3
3711	3714	4	5000	5214	3	7000	8873	4
3725	3749	3	5520	5223	4	9000	9729	3