



CLEAN ENERGY
Technologies

Solar Collector Mirror

Light-Weight Composite Metallic Mirror



SOLAR COLLECTOR MIRROR

The Solar Collector Mirror (SCM) is a result of pioneering research in metal composite technology. Solar collector Mirror is invented, design and developed in USA by US Clean Energy's Khurram Khan Nawab. who, brings this innovation to CSP, CPV and Booster Mirror PV systems that is superior to the conventional glass mirror technology being currently used which is heavy, expensive and highly breakable.

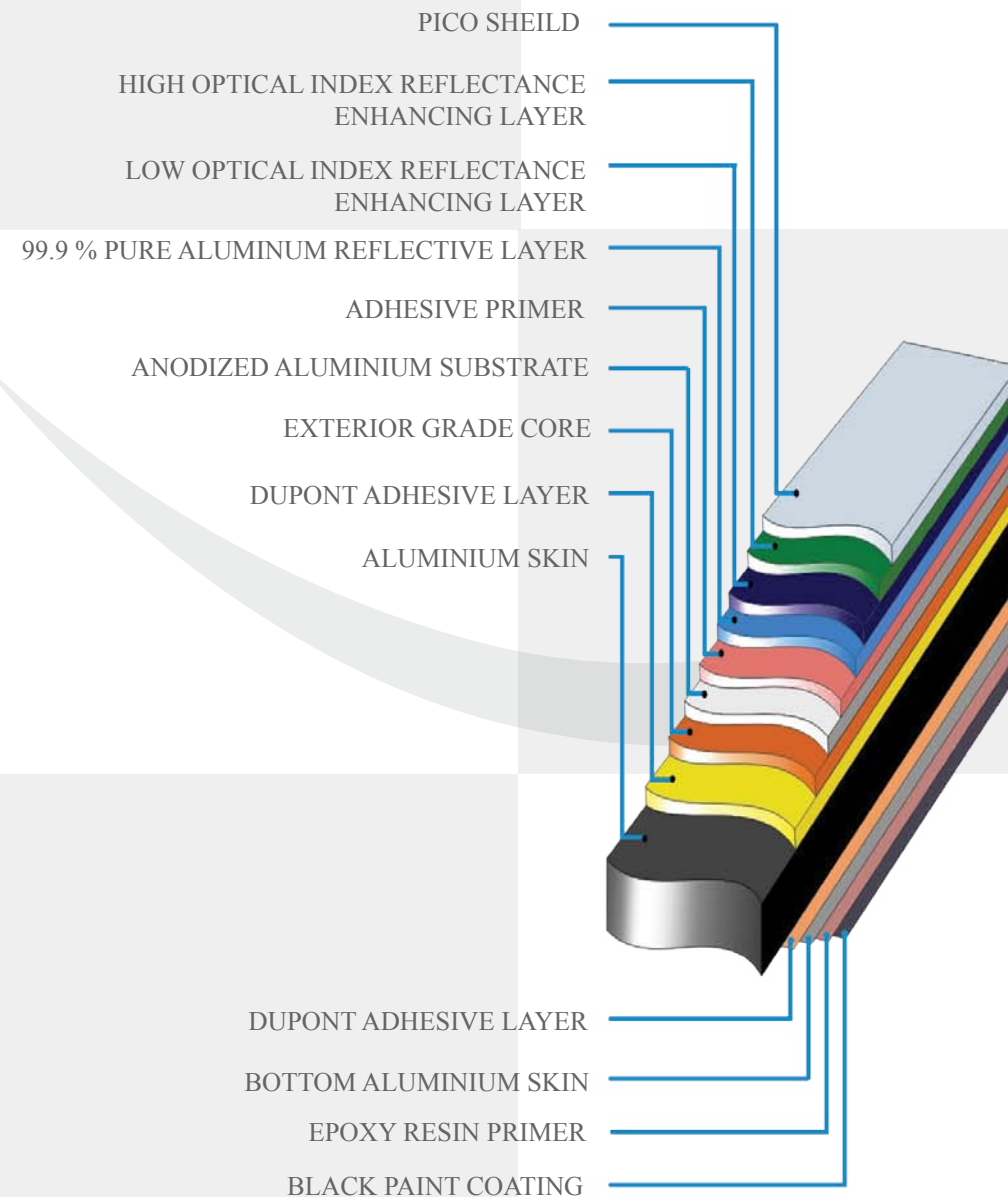
The SCM is a unique worldwide patented composite panel, sandwiching a high durable exterior grade core between two layers of metal skin. the SCM is light weight, features phenomenal flatness which retains its shape and comes with low maintenance. This translates in to easier handling, packaging and shipping.

The SCM requires minimum support structure assembly thereby maximizing ease of installation and fabrication. This results in cost saving in assembly of solar units.

SCM is designed to provide high reflectivity along with rigidity to take and retain parabolic shapes. SCM's have high reflectance ranging from 91% to 95%, strong weather and corrosion resistance, longevity and adhesion properties that provide an advanced alternative to the glass mirror technology.

COMPOSITION

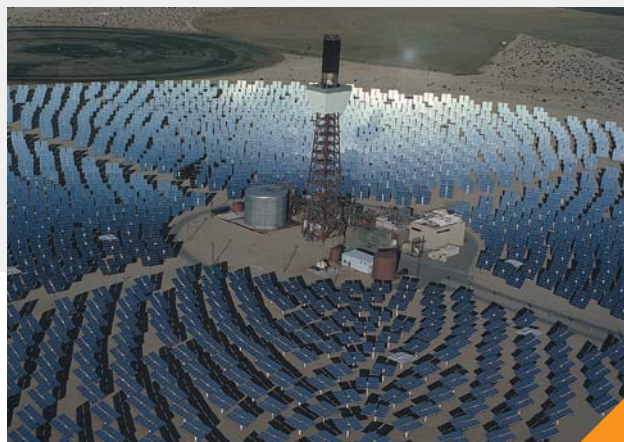
Solar Collector Mirrors (SCM) are the new generation multilayered metal and plastic composite panels.



SOLAR COLLECTOR MIRROR - APPLICATIONS



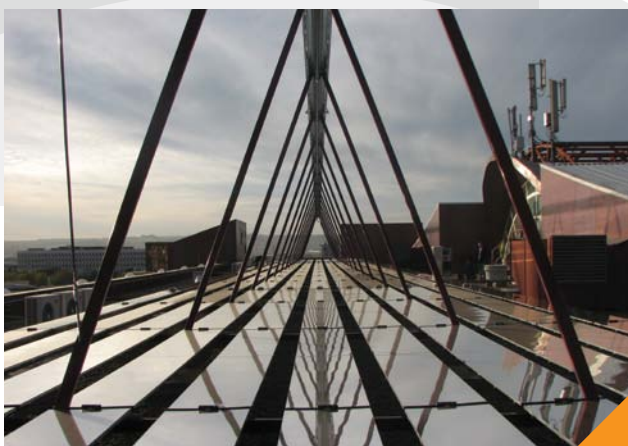
US Clean Energy



Heliostat System



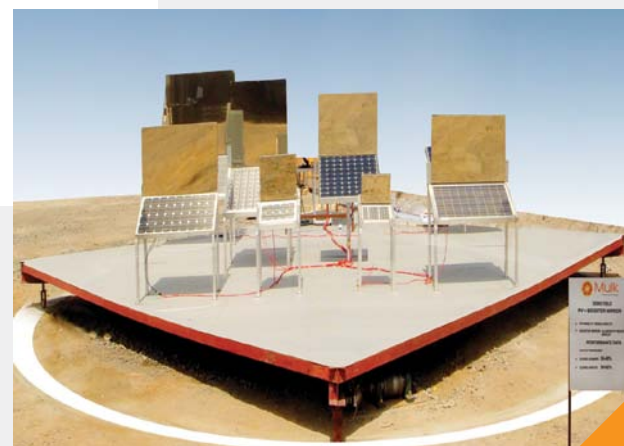
CSP Dish Systems



Fresnel CSP Systems



Parabolic Trough System



Alubond PV Booster Mirror

SOLAR COLLECTOR MIRROR – ADVANTAGES



Unbreakable



On Site Curvature



Mass Production



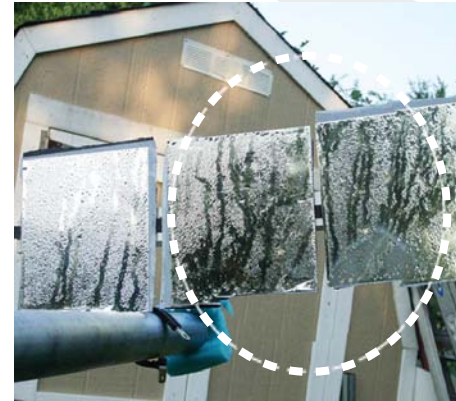
Minimal Substructure



Reduced Weight



Retains Shape



Hydrophilic Effect



High UV Resistance

SOLAR COLLECTOR MIRROR Vs. GLASS MIRROR

- Conventional glass mirrors are heavy and require complex substructure support



SCM

- LIGHT WEIGHT: 3Kgs/m^2
- SUBFRAME: Simple frame
- SHAPE: Achieves deep parabolic angle

CONVENTIONAL GLASS MIRROR

- HEAVY WEIGHT: 10Kgs/m^2
- SUBFRAME: Complex subframe
- SHAPE: Lower parabolic angle

PRODUCT CHARACTERISTICS - SCM 91/95

MECHANICAL PROPERTIES		
DESCRIPTION	SCM 91 / 95	TEST STANDARD
Tensile strength (PSI)	180 N/mm ² (26000)	ASTM D 638 -03
Elongation %	4%	ASTM D 638 -03
Minimum T bend radii	1T	ASTM D 638 -03
Yeild strength (PSI)	165 N/mm ² (24000)	ASTM D 638 -03
180° Bend Test	No Coating Failure	BENISO 1519 ASTM D 4145-83
Falling Ball Impact Test	No Coating Failure	BS EN ISO 6272-1 ASTM D 1400 - 94

WEATHER RESISTANCE PROPERTIES			
DESCRIPTION	SOLAR REFLECTION LOSS		TEST STANDARD
	SCM 91	SCM 95	
QUV Test (3000 h)	<1%	<0.5 %	ASTM GC 154-06
Salt Spray Test (3000 h)	<1.5%	<3 %	ISO 9227
Coefficient of Thermal Expansion (CTE)	+/-0.1 mm Per m ²		ASTM D696 - 03
Temperature Resistance	- 50° C TO + 80° C		ASTM D976
Exterior & coating warranty	25 Years		
Protective coating	PICO Sheild		

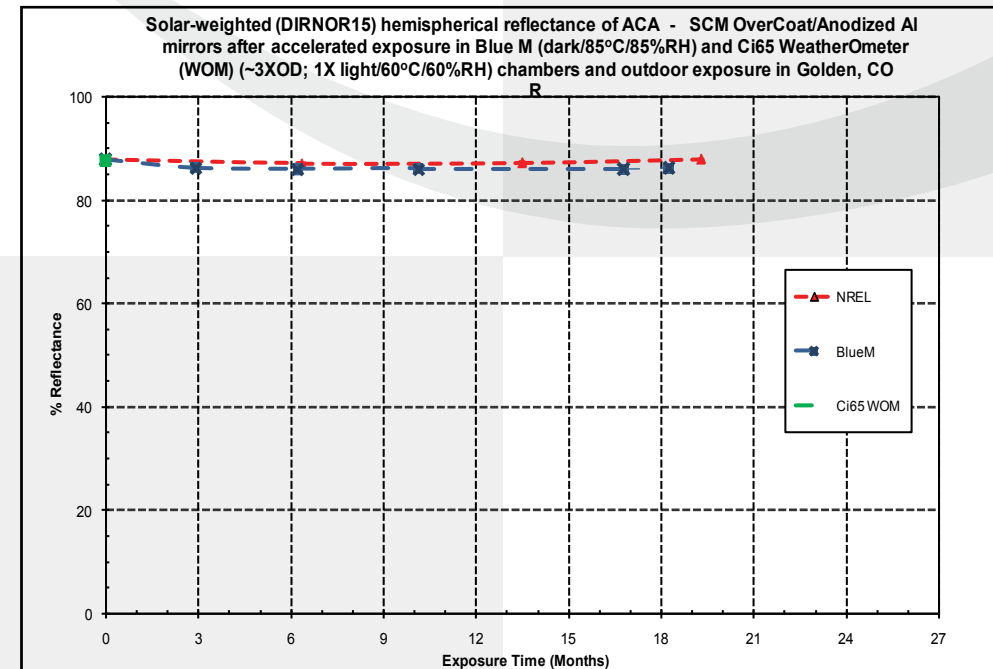
SOLAR COLLECTOR MIRROR Vs CONVENTIONAL SOLAR GLASS MIRROR

SYSTEM COMPONENT MIRROR	CONVENTIONAL GLASS MIRROR SYSTEM	SOLAR COLLECTOR MIRROR
Reflector panel	Heavy Mirror	3 mm Composite Metal
Maintenance	Intensive	Minimal
Exterior warranty	15 to 20 years	25 years
Abrasion resistance	Good	PICO Sheild Coating for Anti Abrasion
Protection in inverted mode	Nil	Metal Skin Protection
Parabolic shape retention	Difficult	Easy
Substructure	Heavy	1/4 th of mirror - Light weight
Loss of reflectivity	Less than 5% in 15 years	Less than 4% in 20 yaers

Recent results-NREL Specula Reflectance with Total Hemispherical

Reflectometer: Note Consistencies of measurements is good In

Real Time RESULT 5 YEARS NO LOSS OF REFLECTIVITY, NO DEGRADATION.



SCM (PICO SHEILD) VS CONVENTIONAL GLASS MIRROR COATING

PROPERTIES	SCM	CONVENTIONAL GLASS MIRROR	TEST STANDARD
Dry Film Thickness	10-11 Microns	Information not available	DIN EN 13523 – 1, ASTM D 339 - 92a
Resistance to Salt Spray Test	600 Hrs - PASSED	480 Hrs - PASSED	DIN EN ISO 9227 NSS, ASTM B 117 -07
Resistance to Humidity	600 Hrs- PASSED	480 Hrs - PASSED	DIN EN ISO 6270 - 2 CH, ASTM D 2247-02
Crosscut Adhesion Test	PASSED	Information not available	DIN EN 13523 – 6, ASTM D 3359 - 02
T - Bend	2 T	Information not available	DIN EN 13523 – 7, ASTM D 4145-83 (2002)
MEK Test	60 DBR	Information not available	MEK TEST - ASTM D 4752

SCM REFLECTANCE PROPERTIES Vs CONVENTIONAL GLASS MIRROR

CONVENTIONAL GLASS MIRROR	TOTAL SOLAR REFLECTANCE		TOTAL REFLECTANCE VISIBLE RANGE	
		92 %		93 %
SOLAR COLLECTOR MIRROR (SCM)	PRODUCT RANGE	TOTAL SOLAR REFLECTANCE	TOTAL REFLECTANCE VISIBLE RANGE	
	SCM 91	91.0 %	91.4 %	

HYDROPHILIC PRINCIPLE (SELF CLEANING EFFECT)

The Solar Collector Mirror have special innovative coating which uses Hydrophilic Principle in which the physical property of a molecule repels from a mass of water. This was observed when water was placed on the Solar Collector Mirror, water did not form droplets but instead fully wets the mirrors to have self cleaning effects.

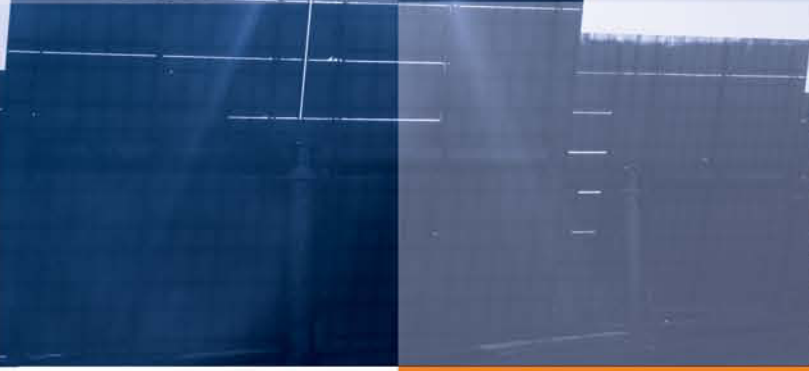
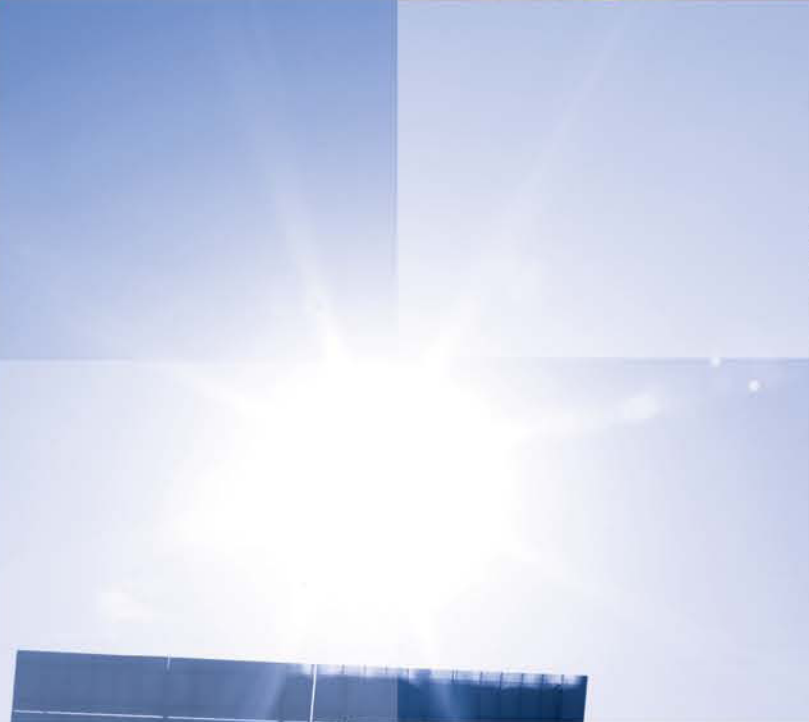
To study the effect of this aspect on solar system performance, samples were mounted on a rack outside on a clear night. The next morning, observations were made. As shown in the picture, Solar Collector Mirror hydrophilic samples appeared to be visually clear.



Solar Collector Mirror



Conventional Glass / Film / Metal Mirror



US CleanEnergy Technologies, Inc.

760 Village Center Drive, Suite 220

Burr Ridge, IL 60527

USA

Tel: (630) 242-6644

Fax: (630) 504-7471

info@cleanenergy.com



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www.cleanenergy.com