Advantages of GSHK FLEX

Integrates with roof surface

- No mounting hardware
- No roof penetrations
- No additional wind loads

Flexible module

- Fits many roof types and surfaces
- Durable, non-breakable
- Theft resistant

Lightweight

- 3.5 kg/m2 (0.7 lb/ft^2) with adhesive
- 2.7 kg/m2(0.5 lb/ft2) NO adhesive
- No structural reinforcement required for older roofs.

High efficiency CIGS

- Up to 12.7% aperture efficiency
- 50% more efficient than flexible a-Si

High performance

- Performs well in all light conditions
- Shade tolerant

Covers entire roof area

- Lays flat. No tilt required
- No module spacing required
- Conforms to roof shape

Large format module

» 250-300 Watts in 5.7m x 0.5m (224.4in x 19.68in) dimensions

» 90-200 Watts available in shorter modules

» 20% BOS & Installation cost savings

As a leading manufacturer of flexible thin film solar panels, we continue to set the benchmark for integration of solar into innovative applications. Our products range from portable solar chargers and building solutions (BAPV) to military applications and emerging innovations.

Flexible, lightweight and powerful; our technology delivers.

GSE manufactures Copper Indium Gallium DiSelenide (CIGS) by using state-of-the- art, controlled co-evaporation and the thinnest stainless-steel substrate possible to create flexible and light weight thin film PV products for use in any application. We offer tried and proven module technology, and partner with industry leading brands to develop solutions for your application. Our proven, controlled and stable production process delivers lightweight and flexible photovoltaic (PV) material from our state-of-art facility in the Arizona, USA, and we have more flexible CIGS installed than anyone else in the world.

Advantages: Light weight, flexible, thin film CIGS panel

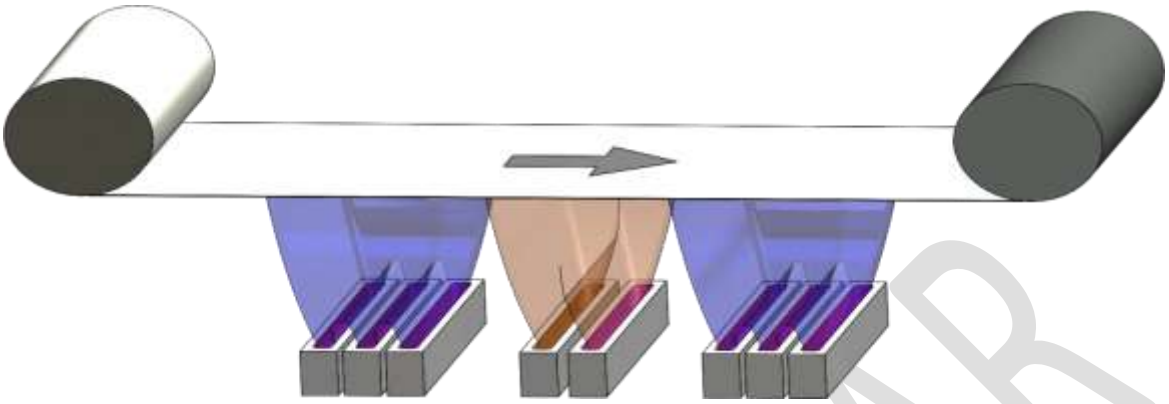
- CIGS offer the highest efficiency of thin film PV technologies
- CIGS offer the highest energy yield at different light conditions
- CIGS offer low environmental impact and sustainability
- Flexible module materials offer low weight per area roof (kg/m2) and low weight per power generated (kg/W)
- Flexible module materials offer low profile and flexible mounting solutions
- Flexible module materials are unbreakable and durable

Established Manufacturing Process

Global Solar Energy's factory is located in Tucson, Arizona and produces flexible solar cells, based on our proprietary CIGS thin film processes, innovative interconnect technology and module structures.

- Location: Tucson, Arizona / USA
- Capacity: 50 MW/yr
- Start of production: March 2008

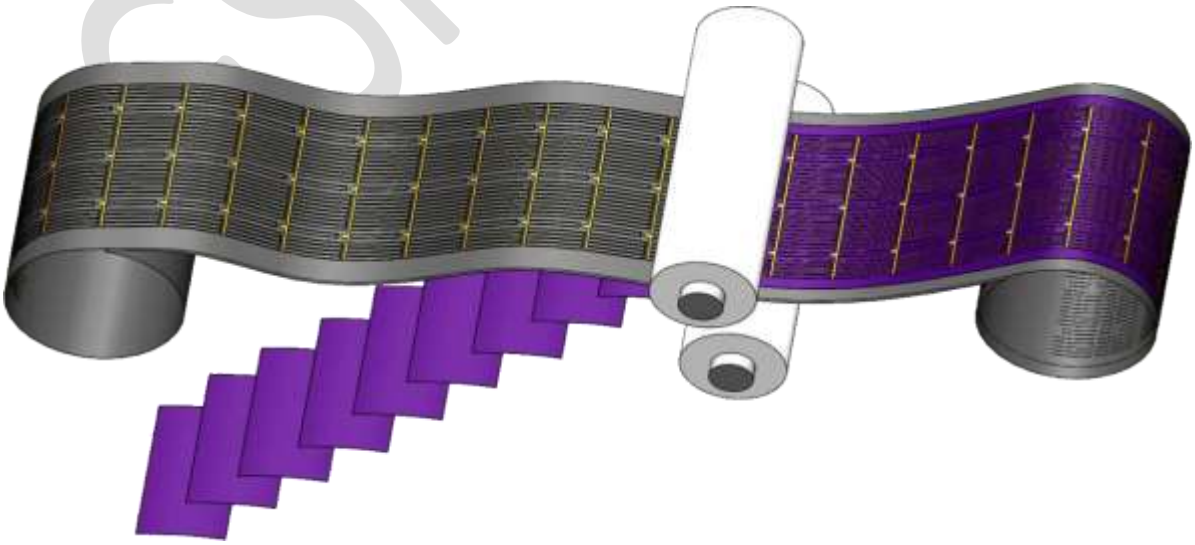
Dissected: flexible thin film CIGS photovoltaic cell



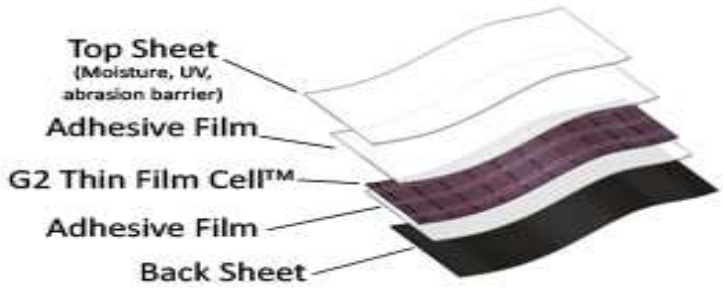
- Lightweight stainless steel foil substrate + roll-to-roll manufacturing → low manufacturing cost
- Co-evaporated CIGS + 3-stage process → high efficiency
- High CIGS deposition rate + compact equipment → low manufacturing cost
- Inexpensive raw materials for evaporating metals + low material usage → low manufacturing costs

Dissected: Cell Interconnect Technology

- Laminating flexible PV cells to a polymer film with patterned metallic conductors → Integrated Cell Interconnect (ICI)
- Low cost raw materials → decreases product cost
- Minimize optical losses + minimize resistive losses → increases conversion efficiency
- Roll to roll lamination process + increase product robustness → high yield process
- Design flexibility + robust submodule handling → enables radical, new product forms



Dissected: Module Packaging Technology



- Optimized product structures available for every application (up to 25 year warranted lifetime)
- UL and IEC certified since 2011 + superior field performance → customer satisfaction
- GSE's intrinsic device stability + reduced vapor barrier requirements → lower product cost and weight (up to 250 W/kg)
- GSE product development + manufacturing experience → high yield production process
- Design flexibility + robust submodule handling → enables radical, new product forms

Sustainability

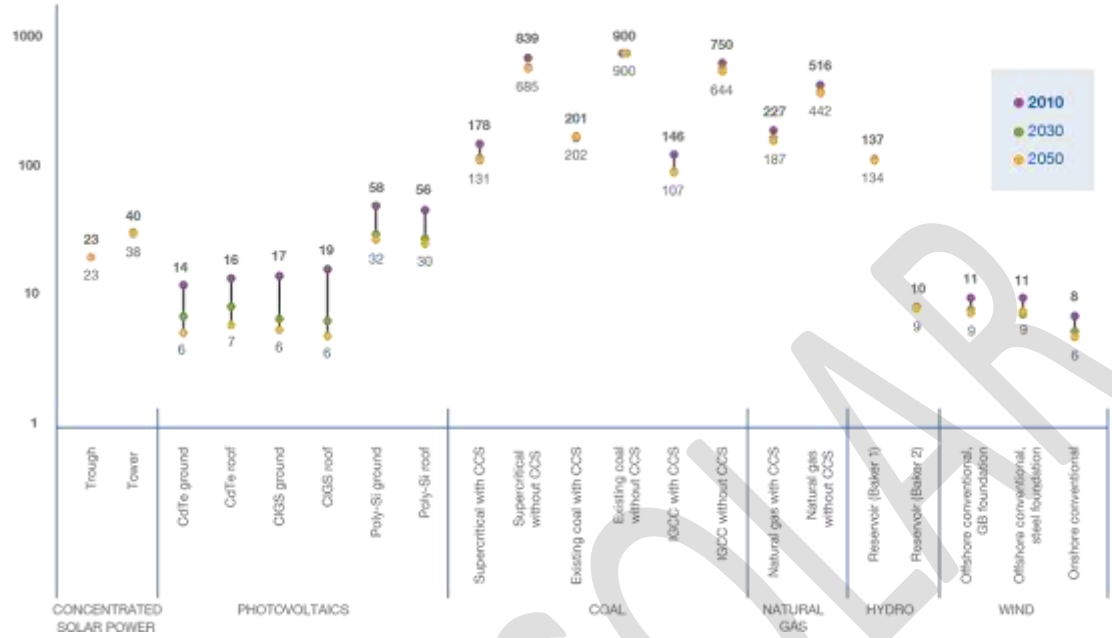
Electricity generated from PV has lower greenhouse gas emissions compared to fossil-fuels.

Electricity generated from CIGS PV has lower greenhouse gas emissions compared to crystalline silicon.

- low material consumption + efficient manufacturing processes → low ecotoxicity and greenhouse gas emissions
- low energy use during manufacturing + high conversion efficiency → fast energy payback times

Figure 1: Life-cycle GHG emissions of different energy technologies, in gCO2e/kWh, reflecting application of the technology in Europe [12].

The numbers for future years reflect a reduction of emissions expected due to technical progress and the reduced emissions in the production of equipment following the implementation of a mitigation scenario.



UNEP (2016) Green Energy Choices: The benefits, risks, and trade-offs of low-carbon technologies for electricity production.