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# Best Thin Film Solar Panels – Amorphous, Cadmium Telluride or CIGS? - Energy Informative

*medicaresolutions*

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## Best Thin Film Solar Panels – Amorphous, Cadmium Telluride or CIGS?

Thin film solar panels accounted for 11% of all solar panel sales in 2011. Production capacity is expected to grow at an annual rate of 24%, reaching more than 22 GW by 2020 (or a global market share of 38% in terms module production).

**There are three primary types of thin film solar panels on the market today:** Amorphous silicon (a-Si), cadmium telluride (CdTe) and copper indium gallium selenide (CIS/CIGS). In the overview chart below you can see their main characteristics:

	<b>a-Si</b>	<b>CdTe</b>	<b>CIGS</b>
<b>Best research-cell efficiency</b>	13.4% <sup>[3]</sup>	19.0% <sup>[3]</sup>	20.4% <sup>[3]</sup>

<b>Best solar module efficiency</b>	8.1%	14.4% <sup>[5]</sup>	14.5% <sup>[6]</sup>
<b>Thin film market share</b>	32% <sup>[2]</sup>	43% <sup>[2]</sup>	25% <sup>[2]</sup>
<b>Advantages</b>	Mature technology Excellent for small devices (e.g. pocket calculators)	Low cost manufacturing	High efficiency Glass or flexible substrates
<b>Disadvantages</b>	Low efficiency High cost equipment	Medium efficiency Rigid glass substrates Cadmium is highly toxic	Costly traditional process Market share expected to grow Requires less cadmium than CdTe solar cells.
<b>Major manufacturers</b>	Sharp	First Solar	Solar Frontier

Protocrystalline, nanocrystalline (nc-Si), black silicon, dye-sensitized solar cells (DSC) and other organic solar cells will not be covered in this article. These technologies still have a long way to go in research and development before they are ready for the market.

Amorphous silicon (a-Si), cadmium telluride (CdTe) and copper indium gallium selenide (CIS/CIGS) have several other benefits and downsides in addition to what you read in the chart above:

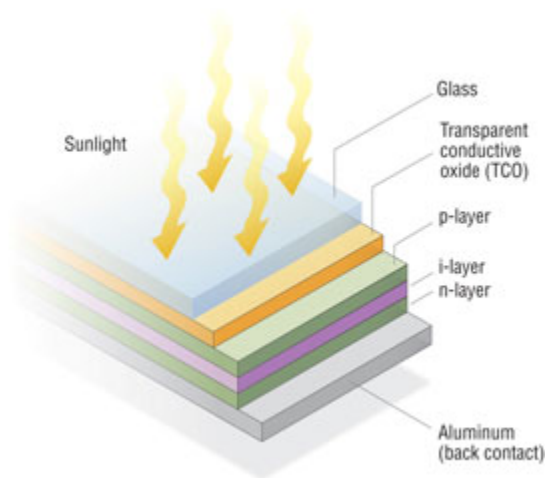
### **Advantages**

- Significantly higher temperature resistance compared to crystalline-based solar panels.
- Many thin-film modules are flexible, which greatly increases the number of potential applications (e.g. curved surfaces, building-integrated photovoltaics).
- Better resistance against shading.

### **Disadvantages**

- Lower efficiency rates mean you need a physically larger system for the same power output.
- Installation costs goes up because you need to install more solar panels.
- Thin film solar panels tend to degrade faster.
- Silicon costs are declining and silicon-based solar panels (e.g. mono- and polycrystalline) are becoming more affordable.

## Amorphous silicon (a-Si)



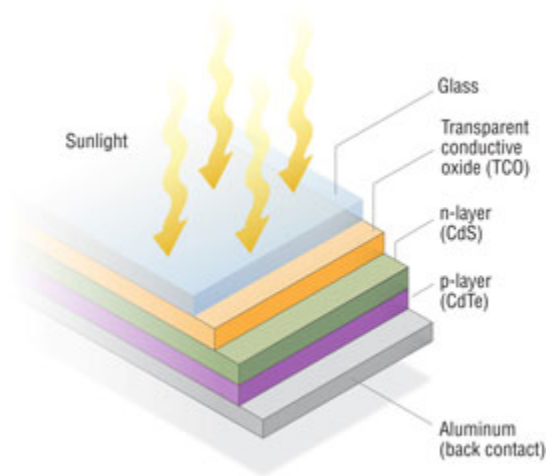
The first thin film solar cells were based on amorphous silicon. The technology is most commonly used in devices that require very little power (e.g. pocket calculators) because of low efficiency rates.

**The future of larger-scale amorphous silicon solar panels does not look very bright:** Sharp retired 160 out of their 320 MW production capacity in Japan earlier this year.

Optisolar, Signet Solar, Unisolar, and many other companies that were touting the amorphous technology are acquired, bankrupt or closed.

Energy Matters, one of the leading solar installers in Australia, recommend amorphous thin film solar panels for their customers in far North Queensland and the Northern Territory due to performance advantages in high temperatures (better heat resistance).

## Cadmium Telluride (CdTe)



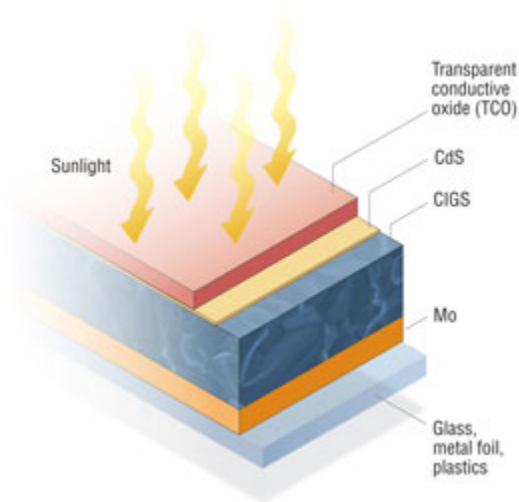
### It's all about First Solar

**when it comes to cadmium telluride solar panels.** Abound Solar has declared bankruptcy and General Electric's PrimeStar is failing. First Solar is the world-record holder for CdTe thin film module (14.4%) and cell (18.7%) efficiency, and backs their solar panels with a limited 25-year power output warranty. The company is currently building a 230 MW solar power plant in Antelope Valley and looks to generate \$0.8 billion to \$1.0 billion of operating cash flow in 2013.

In some situations, typically multi-kilowatt systems in higher temperatures, CdTe-based solar panels can beat mono- and polycrystalline solar panels in terms of costs.

There are, however, environmental issues with products that rely on cadmium – a heavy metal and potential carcinogen that can accumulate in plant and animal tissue. While the threat is minimal as long as the compound is contained within the solar panel, the disposal and recycling can be both dangerous and costly.

### Copper Indium Gallium Selenide (CIS/CIGS)



Solyndra, MiaSolé,

Nanosolar, AQT, Solopower and many more – the list of CIS/CIGS companies that have failed goes on and on. **In the midst of distress sales and bankruptcies, the Japanese manufacturer Solar Frontier seems to be doing something right.** The company recently built out a 1 GW factory and shipped 577 MW worth of solar panels in 2011.

The CIGS-technology might also see some success via Hanergy, a Chinese company that has gained a strong position in the thin film solar market through the acquisition of MiaSolé and Solibro.

In 2013, scientists at Empa, the Swiss Federal Laboratories for Materials Science and Technology, successfully created CIGS solar cells on flexible polymer foils with a new record efficiency of 20.4%. <sup>[3]</sup> This makes CIGS-based solar panels the highest performing thin film solar panels to date.

Also worth mentioning is that less of the toxic material cadmium is present in CIGS solar cells (compared to solar cells made out of cadmium telluride).

**So, which thin film solar panel type is really the best?** First of all, a mono- or polycrystalline solar panel is a better choice for the vast majority of homeowners. If you`re looking for a large-scale system, have the extra space required, and live in an area where the temperature is unusually high, thin film solar panels can make sense. If you want a flexible option, your options are amorphous silicon or CIGS.

The next step would be to predict long-term earnings and costs of specific solar modules. Go for a product that is backed up with a good performance guarantee/warranty.

If you want expert guidance to find out which solar panel is better in your situation, simply request a Free Solar Consultation.