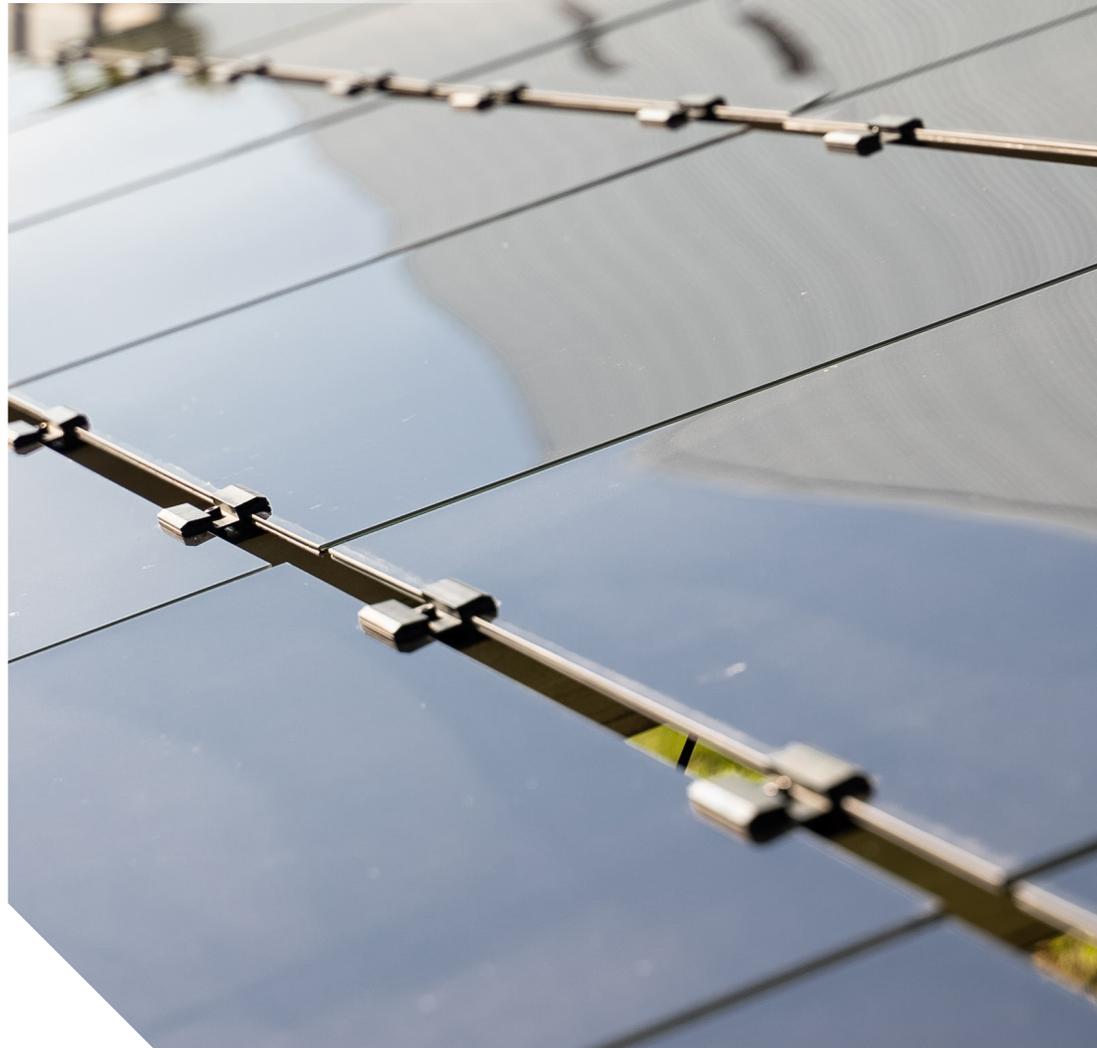




TOLEDO
SOLAR



TOLEDO SOLAR

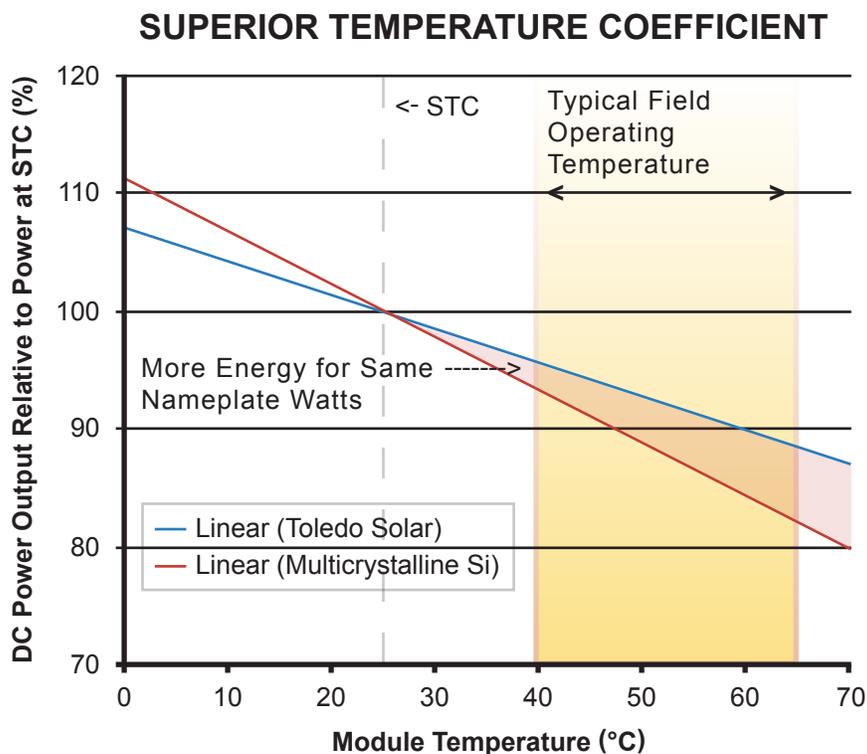
THIN-FILM CdTe PV

Faster Payback period, higher energy yield, and long-term reliability from an affordable, field-proven module. Thin-Film CdTe photovoltaic (PV) technology continues to set performance records in both research and real-world environments.

SPECIFIC ENERGY YIELD ADVANTAGE

RECORD SETTING PERFORMANCE

Our 18.0% thin-film module efficiency beats the best-in-class silicon (Si) in total Power output. Toledo Solar produces the most innovative design and quality construction leading the solar industry's most rigorous degradation protocols.



SPECIFIC ENERGY YIELD ADVANTAGE

Thin-film high efficiency modules have a proven specific energy yield advantage to deliver more usable energy per/nameplate watt than conventional Si modules. Specific annual energy yield captures data over a year of module performance during varying real-world conditions where temperature, sunlight intensity, and solar spectrum all change throughout the days and seasons.

$$\text{Specific Energy Yield} = \frac{\text{Total Energy (MWh) Produced}}{\text{Installed Nameplate Capacity (MWp)}}$$



SPECIFIC ANNUAL ENERGY YIELD

A
SUPERIOR
TEMPERATURE
COEFFICIENT

UP TO 3% MORE
SPECIFIC ANNUAL ENERGY
YIELD (SY) THAN c-Si

B
BETTER
SPECTRAL
RESPONSE

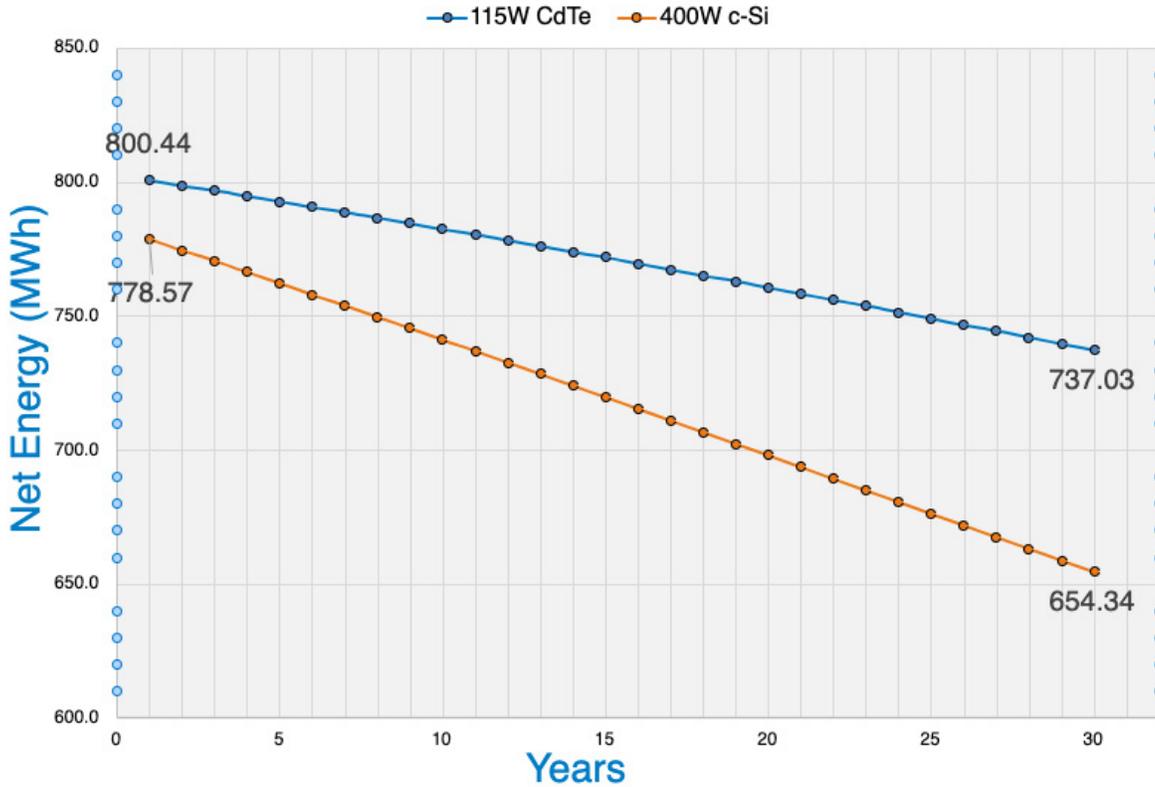
UP TO 6% MORE
SPECIFIC ANNUAL ENERGY
YIELD (SY) THAN c-Si
IN HUMID CONDITIONS

C
BETTER
SHADING
RESPONSE

1% MORE
SY THAN c-Si

A+B+C = 10% Better Specific Annual Energy Yield

30 Year Comparison



UP TO 50% LESS DEGRADATION THAN Si!

MINIMAL POWER LOSS WITH BETTER SHADING RESPONSE

When shading occurs, thin film's unique cell design ensures only the shaded portion is impacted, while the rest of the module continues to produce power. Typical Si modules turn off disproportionately large portions of module to protect them from damage. In an environment with 10% shading, a thin film module will still produce 90% power, compared to a 30% loss of power with a standard Si module.

SPECTRAL RESPONSE ADVANTAGE IN HUMID CONDITIONS

Sunlight is comprised of multiple wavelengths and various intensities of light. The intensity of wavelengths that reach earth's surface is influenced by atmospheric conditions. The largest impact on intensity is due to water vapor in the atmosphere, commonly correlated to high humidity. PV technologies respond differently to different light wavelengths. On humid days, water in the atmosphere reduces specific wavelengths of available light. Because CdTe modules are less sensitive to reductions in wavelengths most affected by this type of high atmospheric water content, the thin-film modules produce up to 6% more annual energy in humid conditions.

HIGHER ENERGY PRODUCTION IN HOT CONDITIONS

The nameplate power for all PV modules, regardless of manufacturer or technology, is established at standard test conditions (STC). Standard test conditions do not define an ambient operating temperature, but do define the PV module temperature as 25°C. Module temperatures are typically 25°C to 30°C above the ambient temperature. As the module temperature exceeds the STC of 25°C, the power output for all PV modules decrease. In warm and hot climates, the module operating temperature will exceed 25°C for as much as 90% of the generating hours, resulting in a decrease in power. The temperature coefficient of a module can be used to calculate the power decrease as the module temperature increases. The CdTe thin-film panels have a 20% lower temperature coefficient than Si modules and will produce more energy as the module temperatures increase. For example, on a 40°C day, a thin-film module would reach 65°C operating temperature. In such conditions the thin-film modules produce up to 5% more power than Si modules on average. Over a year in hot climate conditions, this high temperature advantage adds up to 3% more annual energy than Si modules.

LOWER LEVELIZED COST OF ELECTRICITY

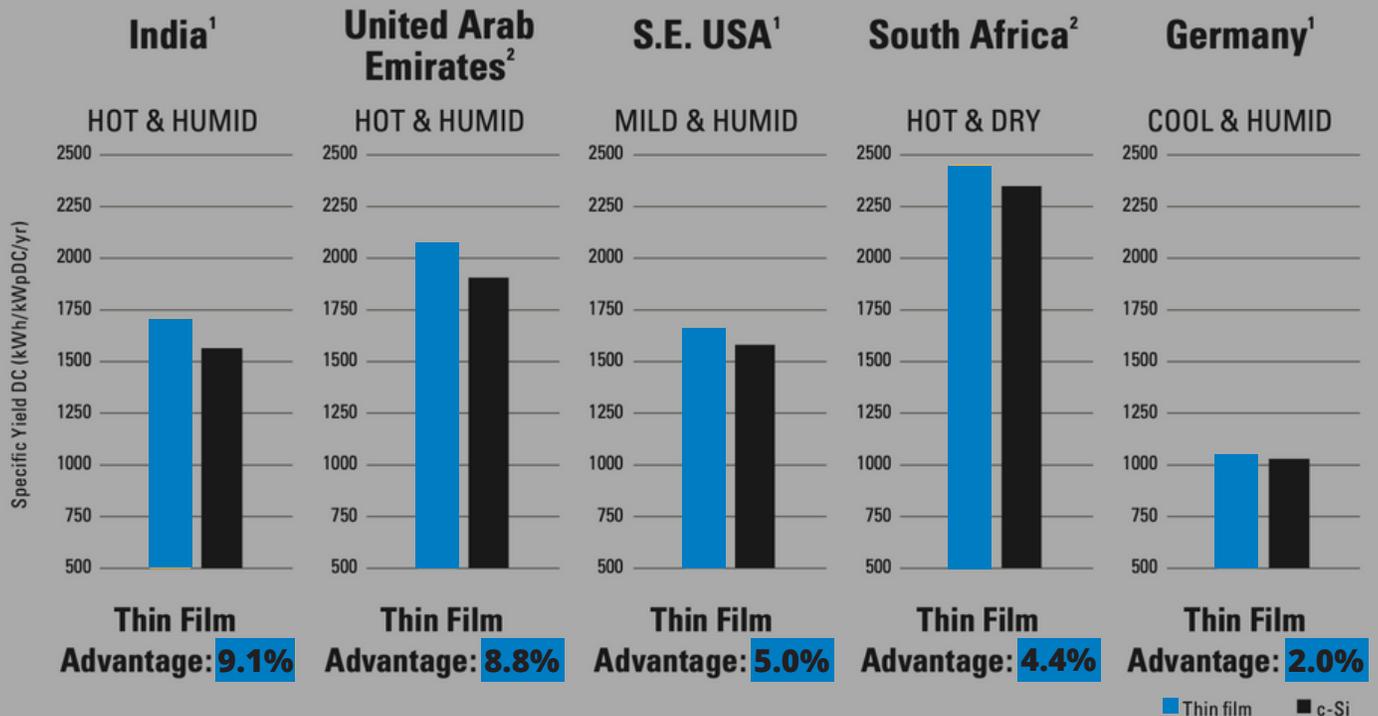
Greater Energy Yield Drives Lower Levelized Cost of Electricity (LCOE)

While module efficiency identifies the power produced by a module in standard test conditions, the specific annual energy yield metric shows the energy produced in a year of real world conditions. When evaluating return on investment (ROI) for a solar power plant, energy yield has a big impact on the overall LCOE. Thin-film high efficiency modules are proven to deliver more usable energy per nameplate watt than conventional silicon-based modules.

For an equivalently designed and installed power plant priced at the same \$/watt, a thin-film plant will produce more energy, resulting in a lower LCOE (\$/MWh).



Specific annual energy yield in different regions of the world:



¹ PV Syst energy simulation of equivalently designed fixed tilt arrays comparing thin film PV modules to 'tier 1' 72-cell multi-crystalline silicon utility scale pv modules

² PV Syst energy simulation of equivalently designed single-axis tracker arrays comparing thin film PV modules to 'tier 1' 72-cell multi-crystalline silicon utility scale pv modules

INCREASING VALUE



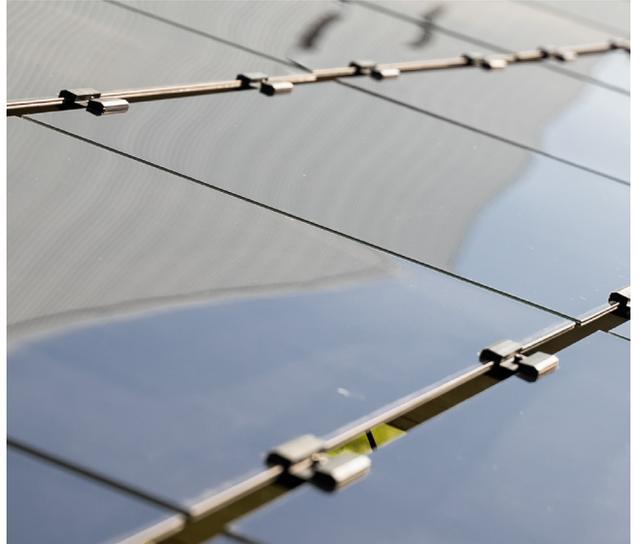
Predictable lifetime energy is critical to confidently project the expected value of sellable energy from a PV system designed for long-term operation. The quality and reliability of thin-film technology is proven both in short and long-term field performance that meets or exceeds expected returns. With the solar industry's rapid innovation cycles, PV technology relies on independent laboratory-accelerated testing protocols to determine the suitability and performance of modules in the field. Independent lab test results backed by a 30-year linear output warranty ensure your module will provide reliable lifetime performance.

CdTe modules have been field-deployed and independently monitored by NREL with a documented long-term median power degradation rate of -0.3% per year. This low degradation rate positively impacts the long-term reliability and LCOE over the life of the entire system.

Test	Description	Results
IEC 61730/IEC 61215 Certification	Standard International Solar Certification	PASS 1000V Certification Level

LOW-COST FINANCING

There is unparalleled use of thin-film modules in financed projects around the world. Many financial institutions appreciate the integrity of thin-film projects and market-leading technologies in high yield solar projects for their superior ROI. The world's leading PV investors and financial institutions see a pattern of more value and less risk than competing alternatives. Thin-film topped the list of the 20 PV module brands most used in debt-financed projects in Bloomberg New Energy Finance's report, "PV module bankability 2014: where's the trust?"



Engineering Procurement Construction (EPC)

Toledo Solar offers 100% financing for commercial and industrial solar projects through Engineering Procurement Construction.

Contact us today for more information on how we can help you finance your solar project!

THE BETTER CHOICE

More Energy – Lower LCOE

From large industrial installations to small rural communities, your thin-film installation produces more energy, more consistently, over the long term. By design, thin-film technology delivers a higher energy density than the competition. Through predictable performance and a lower rate of depreciation, thin-film technology lowers LCOE.

SUPERIOR PANELS

- 100% Made in U.S.
- Higher Quality
- More Durable
- More Stable
- ESG Friendly
- More Energy
- Fastest Energy Payback Period

