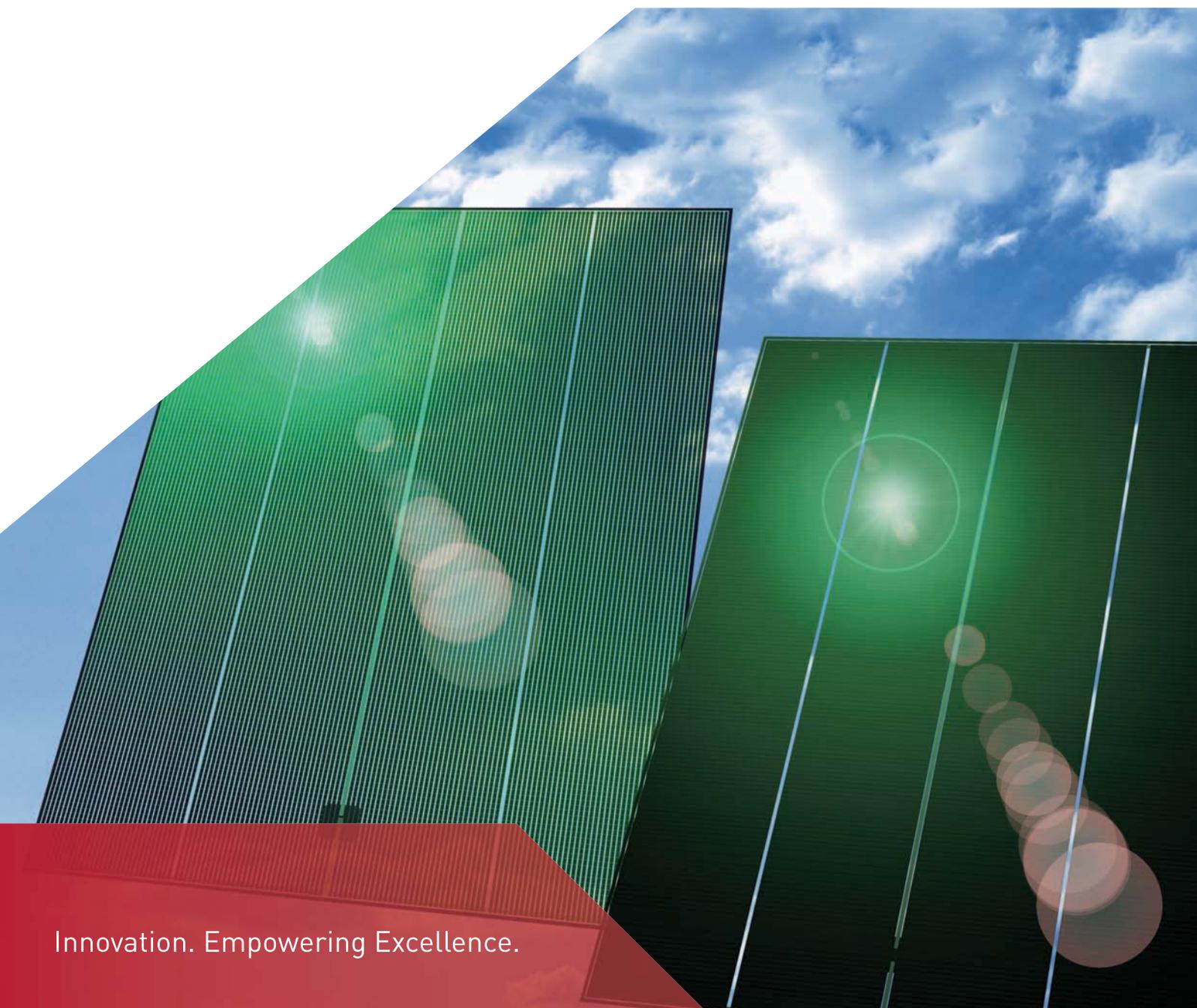




CTFSOLAR

Innovative Technologies from the Original

One of the most vibrant areas of the photovoltaic industry is provided by its original inventor. Reaching Grid Parity through inexpensive processing, economic use of material, high energy conversion efficiencies and a strong potential for further cost cutting.



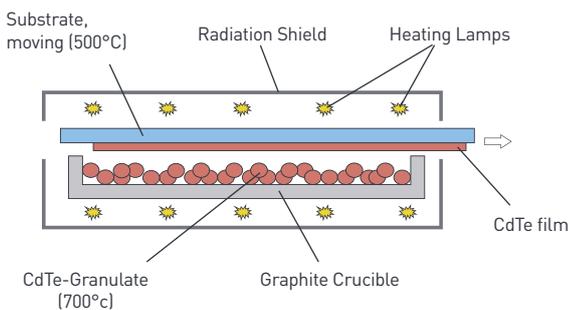
Innovation. Empowering Excellence.

CTF SOLAR

The Original

With the experience of the team members that originally invented Thin Film PV modules based on the reliable cadmium telluride (CdTe) technology, CTF SOLAR provides excellent expertise in one of the most vibrant areas of the photovoltaic industry. CdTe has been recognized as the markets most cost efficient solution for PV applications, owing to its inexpensive processing, economic use of material and high energy conversion efficiencies.

CdTe therefore is generally expected to be the first photovoltaic technology to reach grid parity, sustainably. Benefitting from intensified efforts in research and development, it is becoming the “working horse” of solar industry worldwide and is very quickly evolving into the next generation of solar energy.



Leadership in CAPEX and Production Costs

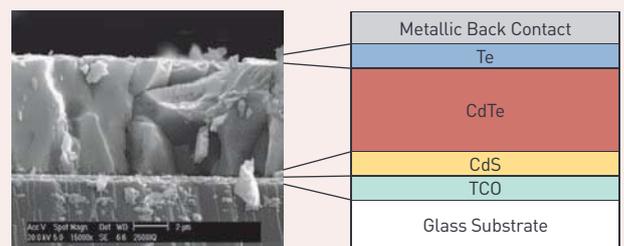
CdTe Solar factories designed by CTF Solar enable cutting CAPEX and production costs dramatically:

- > CAPEX comes down into the region between **0.50 €/W_p** and **0.35 €/W_p**, depending on factory size (between 100 MW_p and 300 MW_p)
- > Production costs down to less than **0.35 €/W_p**

Leadership in Energy Payback Time

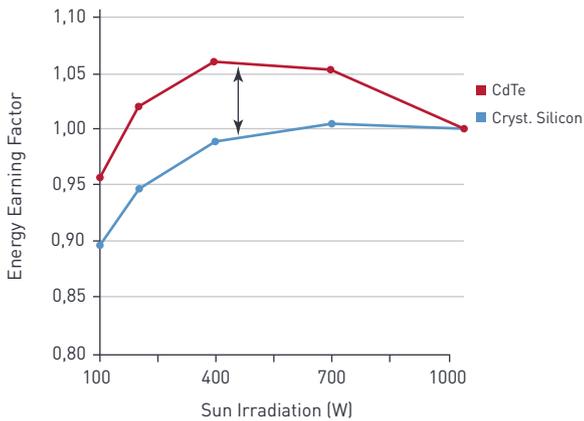
Extremely short energy payback time: The time in which the solar module produces the same amount of energy as was spent for its fabrication for CdTe modules is as low as 6 months, compared to over two-years for a conventional crystalline silicon module.

Cross Section View of a CdTe Solar Cell



Excellent Low Light Behavior

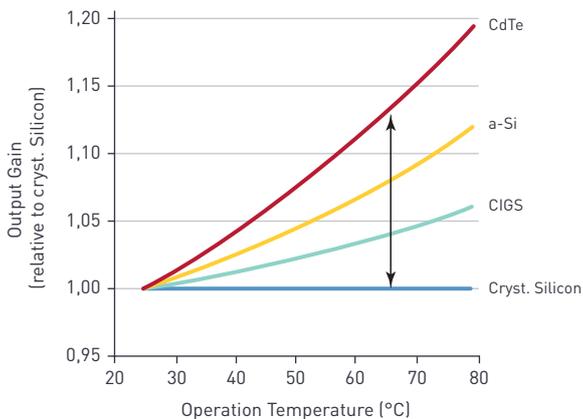
The efficiency of CdTe panels increases with decreasing sun radiation and the collection of diffuse sunlight is also very efficient. Therefore, they show high yields even in cloudy weather as is typical for Central Europe.



Additional energy provided by a CdTe solar module at real irradiation conditions.

Excellent High Temperature Behavior

While the energy conversion efficiency of solar modules typically decreases with higher temperature, with CdTe solar modules the decrease is significantly less pronounced compared to other technologies.

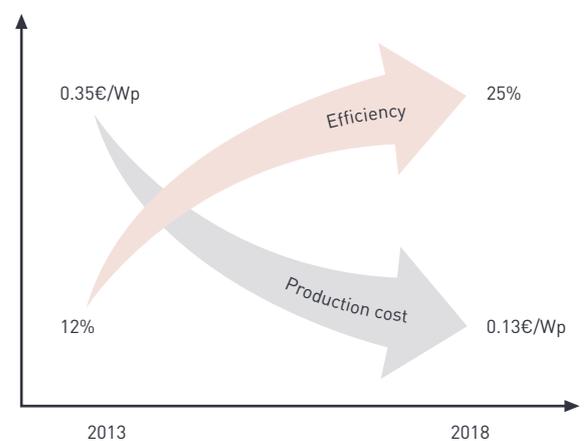


Up to 15% additional energy output by a CdTe solar module at real operation temperature relative to crystalline silicon.

Strong Potential for Further Cost Cutting

Maximum potential of CdTe is not even close to being reached yet: The theoretical conversion efficiency is around 30% which is the highest value among all technologies known in the market. Today's laboratory efficiencies of 18% already indicate a strong optimization potential.

In commercial production of CdTe module conversion efficiencies easily reach 13% with some record modules hitting efficiency levels known from crystalline silicon modules.



Together with leading scientific institutes CTF Solar has established a development and cost cutting road map leading to conversion efficiencies of 25% and production costs as low as 0,13 €/WP within the next 5 years.

Innovation. Empowering Excellence.



CTF SOLAR

CNBM

Our History

Excellence Based on Experience

The successful story of CTF SOLAR is based on both innovative ideas and substantial knowledge of solar technology. Although today's brand name has only been established some years ago, the factual history is much longer. A large proportion of the members of the CTF SOLAR team have been involved for several decades in the development of solar cells and solar modules and in applying the results of this work to the implementation of solar production lines.

One of those „founding fathers“ is Dr. Dieter Bonnet who in 1969 created the world's first functioning cadmium telluride (CdTe) solar cell. In the 1990s Bonnet and his co-founders Dr. Michael Harr and Karl-Heinz Fischer in the same way pioneered the commercial production of CdTe modules by constructing the first factory in Germany. Later on, the know-how and the experience in designing and implementing of solar factories was transferred to CTF SOLAR GmbH.

In 2008 the company was acquired by Roth & Rau Group with the purpose to develop and sell turnkey production lines for the production of CdTe solar modules, marking the Group's entry into this promising technology. When Roth & Rau announced in February 2011 that it would return to focusing on individual machines based on plasma technology, the foundation for a new partnership was laid.

In Shanghai-based CTIEC (China Triumph International Engineering Corporation), a company of the Beijing-based CNBM Group, CTF SOLAR has found a financially strong new owner and partner who is already established in the international solar business. This cooperation will enable CTF SOLAR, with its experienced team of engineers and scientists, to continue along its successful path as a supplier of CdTe solar module factories.

Innovation. Empowering Excellence.

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