
Creating ideas from business



Dipl.– Phys. Tilmann E. Kuhn

IEA , 27th of April

Fraunhofer-Institut for
Solar Energy Systems ISE

Contents of the talk

- Introduction Fraunhofer Society and Fraunhofer ISE
- creating business from ideas – principles
- creating business from ideas – examples from Fraunhofer ISE
 - new solar control systems
 - new solar thermal systems
 - new PV-systems

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Fraunhofer Institute for Solar Energy Systems ISE

Director:
Prof. Eicke R. Weber

Staff: >930

Budget: €55 million

Established: 1981



The Fraunhofer Gesellschaft

- Leading organization for applied research in Europe
- 17,000 employees, the majority of whom are qualified scientists and engineers
- 59 research institutes at different locations throughout Germany
- Annual research budget of more than 1.6 billion euros
- 2/3 of the research contracts are from industry and public funds
- International cooperation is supported through affiliate institutes in Europe, USA, Asia and the Middle East



Top Patent Applicants in Germany 2008

Deutsches
Patent- und Markenamt



Anmelder	Anmeldungen	Sitz
1. Robert Bosch GmbH	2 645	D
2. Siemens AG	1 741	D
3. Daimler AG	1 279	D
4. GM Global Technology Operations Inc.	994	USA
5. Denso Corp.	716	Japan
6. Bayerische Motoren Werke AG	632	D
6. Continental Automotive GmbH	632	D
8. Schaeffler KG	605	D
9. ZF Friedrichshafen AG	594	D
10. Volkswagen AG	592	D
11. Audi AG	488	D
12. Infineon Technologies AG	472	D
13. BSH Bosch und Siemens Hausgeräte GmbH	468	D
14. Fraunhofer-Gesellschaft	384	D
15. Voith Patent GmbH	353	D

Quelle: Deutsches Patent- und Markenamt, Stand Juni 2009

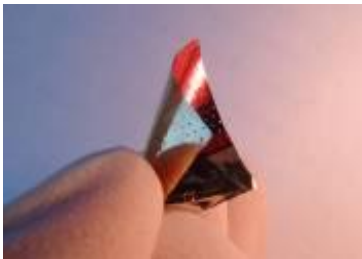
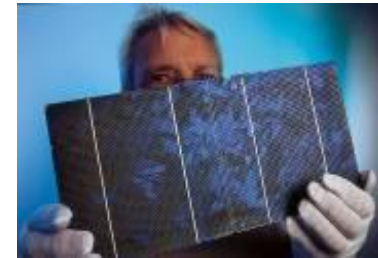
Fraunhofer Establishments, worldwide



Research, Development and Services at Fraunhofer ISE



Research
Materials
Modelling
Methods



Development
Components,
Prototypes,
Systems, Procedures



Services
Consulting, Tests
Monitoring
Quality Assurance

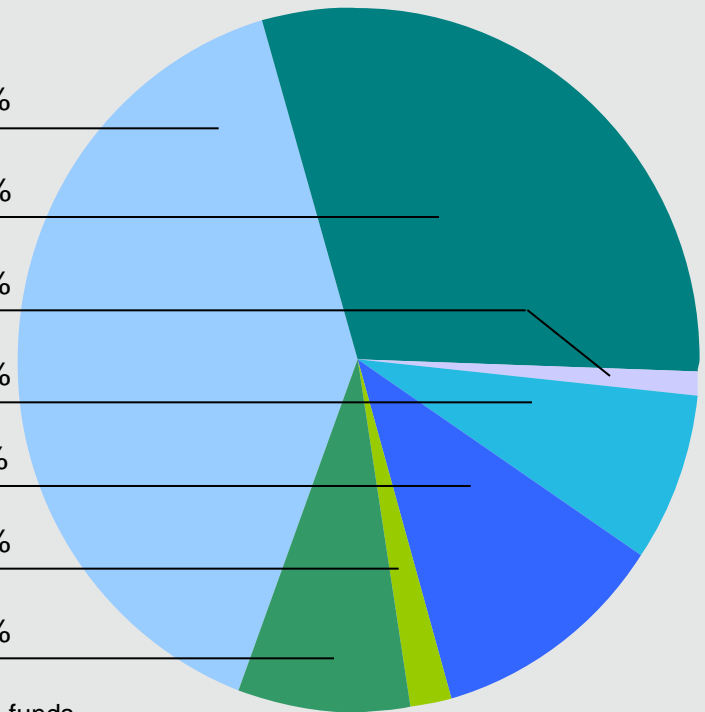


Revenue Structure, Operation 2009 (preliminary)

Operation: €47.3 million
Investment^{**}: € 7.7 million

Total: €55.0 million

Industry	40 %
Federal Gov. Projects	30 %
Regional Gov. Projects	1 %
European Union	8 %
Others	11 %
Special Programs, FhG	2 %
Basic Funding*	8 %

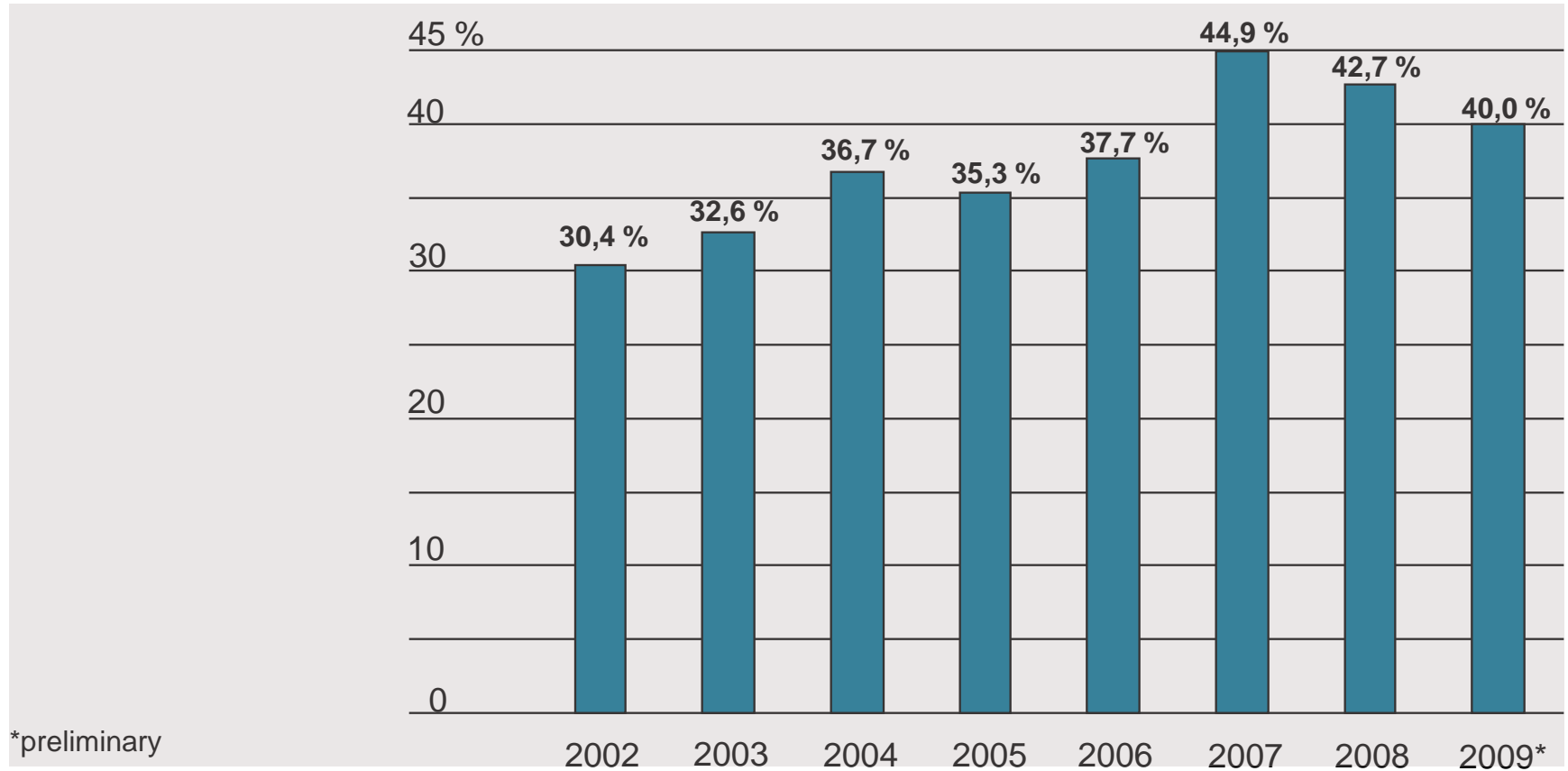


* of which 90 % federal and 10 % state funds

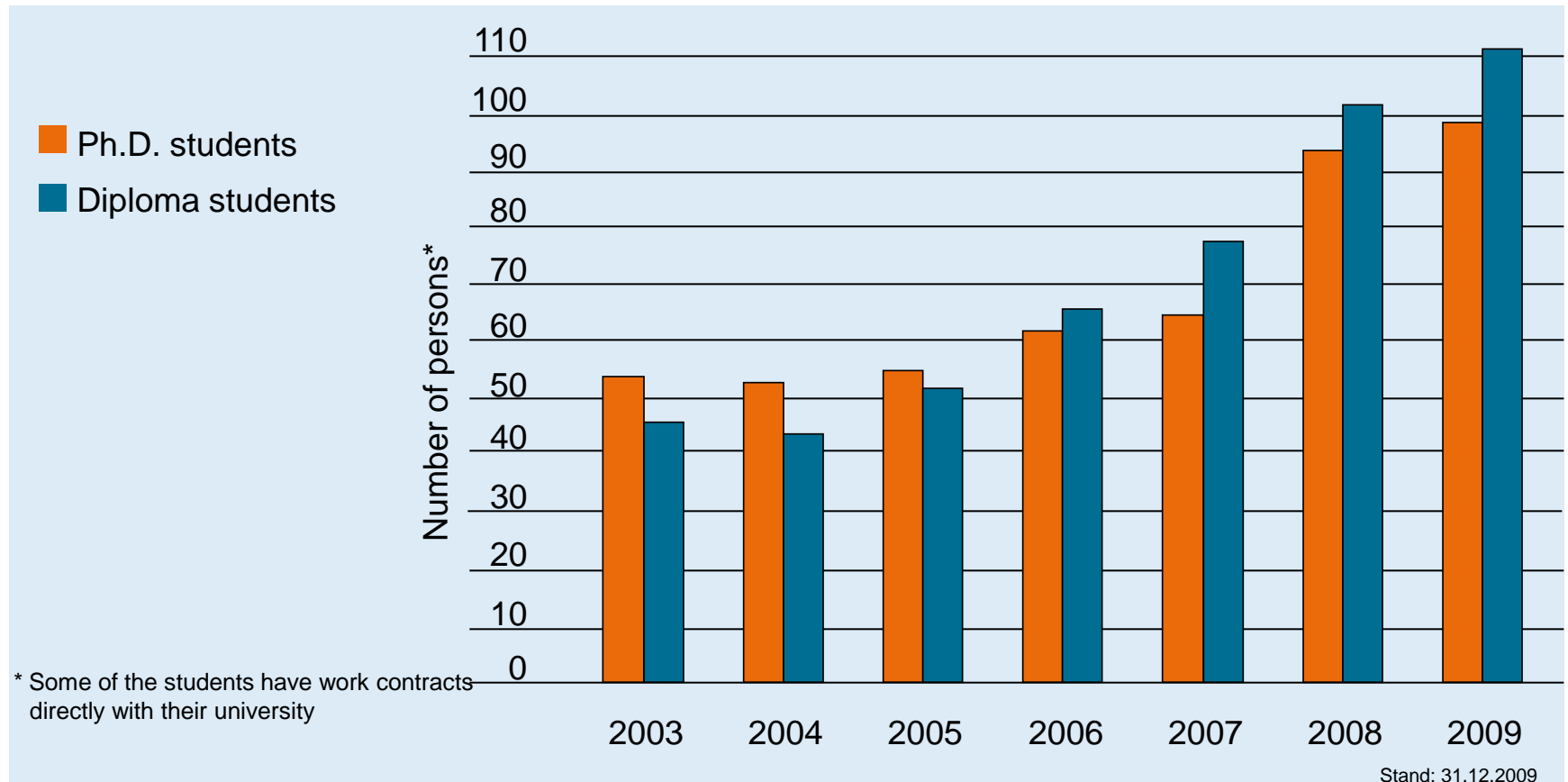
** without building investment and economic program

Stand: Jan 2010

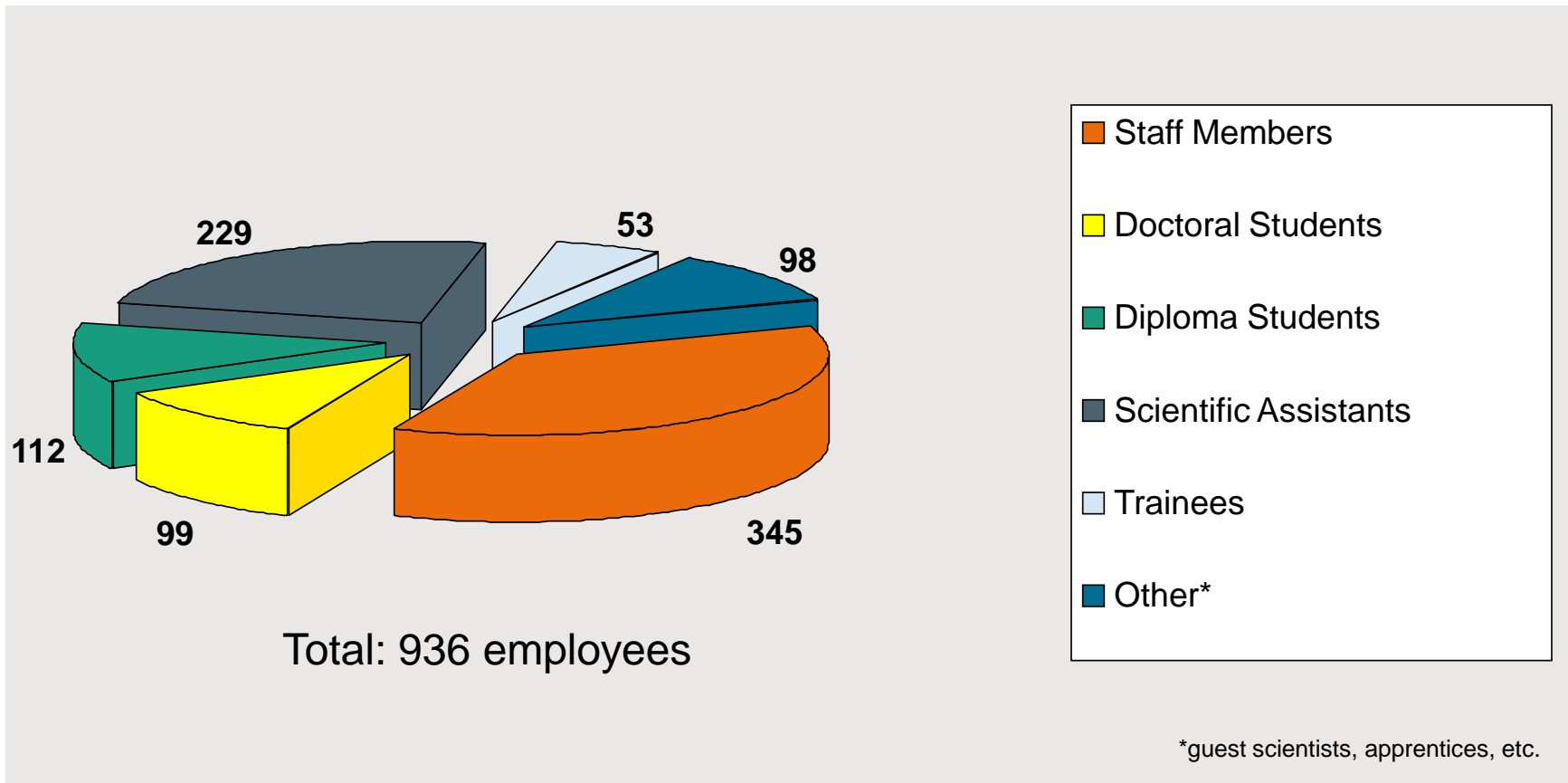
Percentage from Industry in Total Revenue



Ph.D. and Diploma students at Fraunhofer ISE



Personnel Fraunhofer ISE 2009



Areas of Business at Fraunhofer ISE

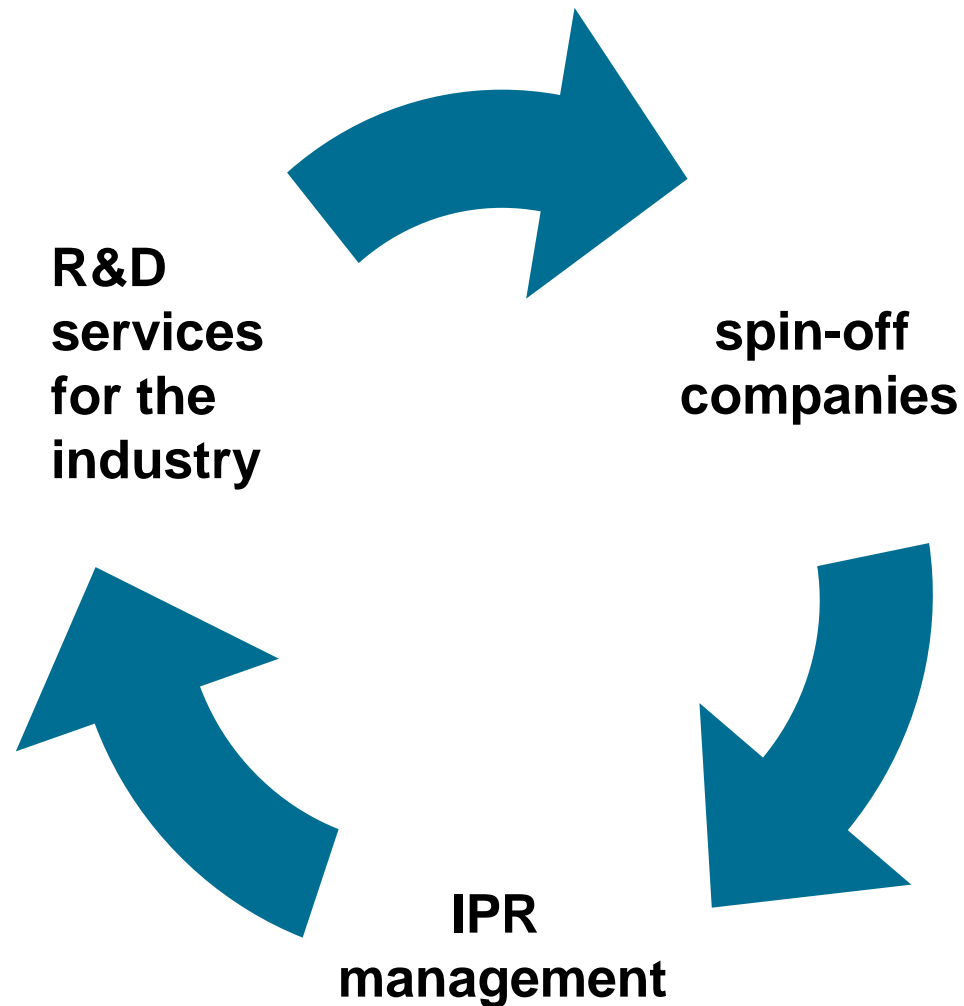
- Energy Efficient Buildings and Technical Building Components
- Applied Optics and Functional Surfaces
- Solar Thermal Technology
- Silicon Photovoltaics
- Alternative Photovoltaic Technologies
- Renewable Power Supply
- Hydrogen Technology



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ideas to business - three different paths



Content of the talk

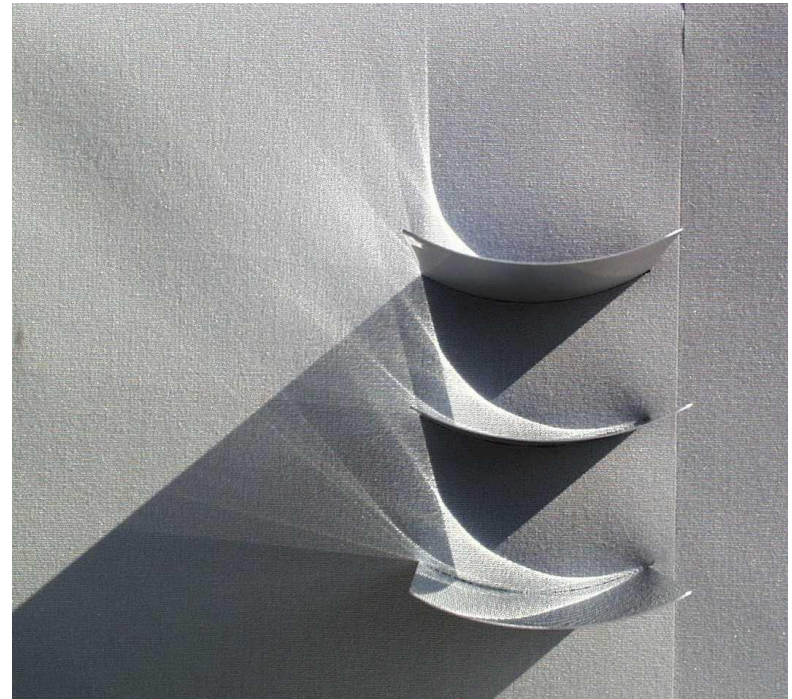
- Introduction Fraunhofer Society and Fraunhofer ISE
- creating business from ideas – principles
- creating business from ideas – examples from Fraunhofer ISE
 - **new solar control systems**
 - venetian blind with “genius slats”
 - new solar thermal systems
 - new PV-systems

„Genius“: Common development with the industry + common patent with exclusivity

internal venetian blinds



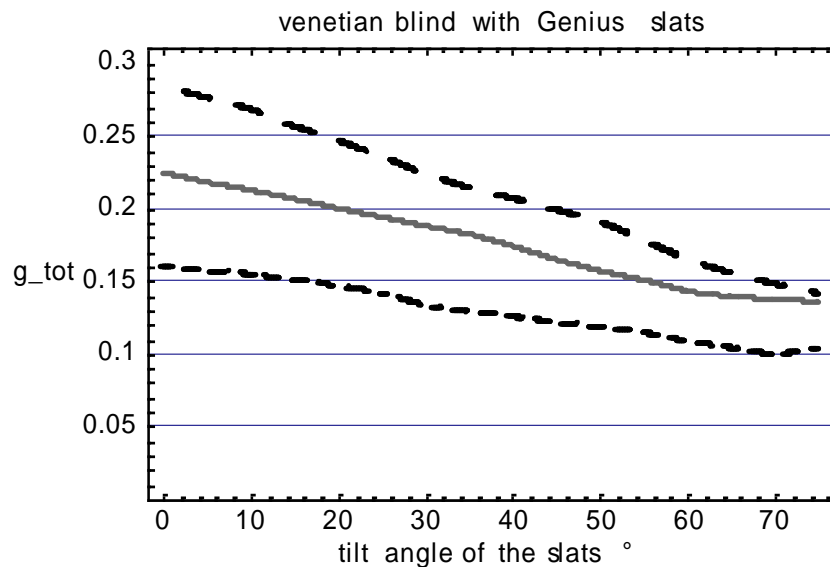
Copyright: Warema (genius slats)



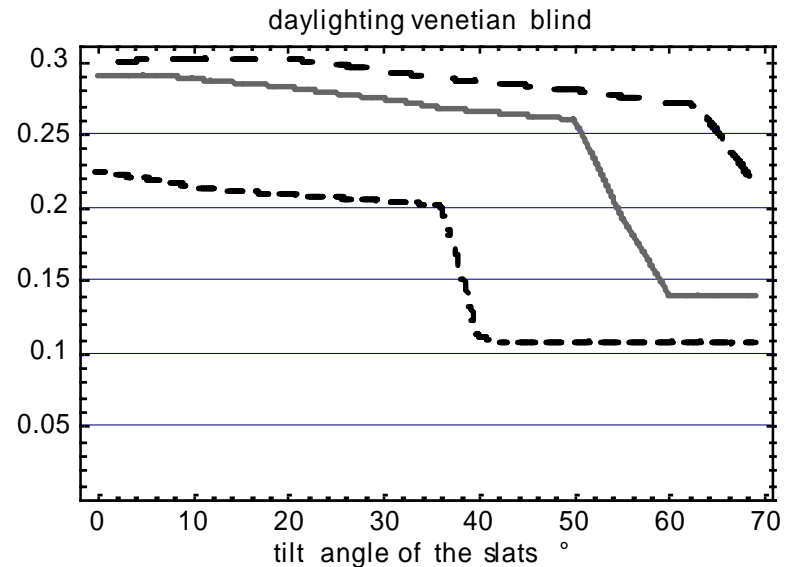
Copyright: Warema (daylighting blind)

„Genius“: Common development with the industry + common patent with exclusivity

internal blinds with solar control glazing ($g_{\text{DGu}} = 0.31$)



— — 0.° solar altitude
— 30° solar altitude
- - - 60° solar altitude



— — 0.° solar altitude
— 30° solar altitude
- - - 60° solar altitude

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 - **new solar thermal systems**
 - transparent solar thermal collector
 - absorber design “FracTherm®”
 - new PV-systems

Patents as starting point for research projects



EU-Project “cost-effective”:
Converting facades of existing
high-rise buildings into energy
gaining components

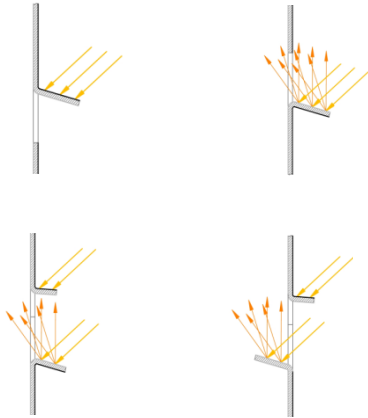
www.cost-effective-renewables.eu

Torre de Cristal Madrid

Source: Emmer Pfenninger Partner

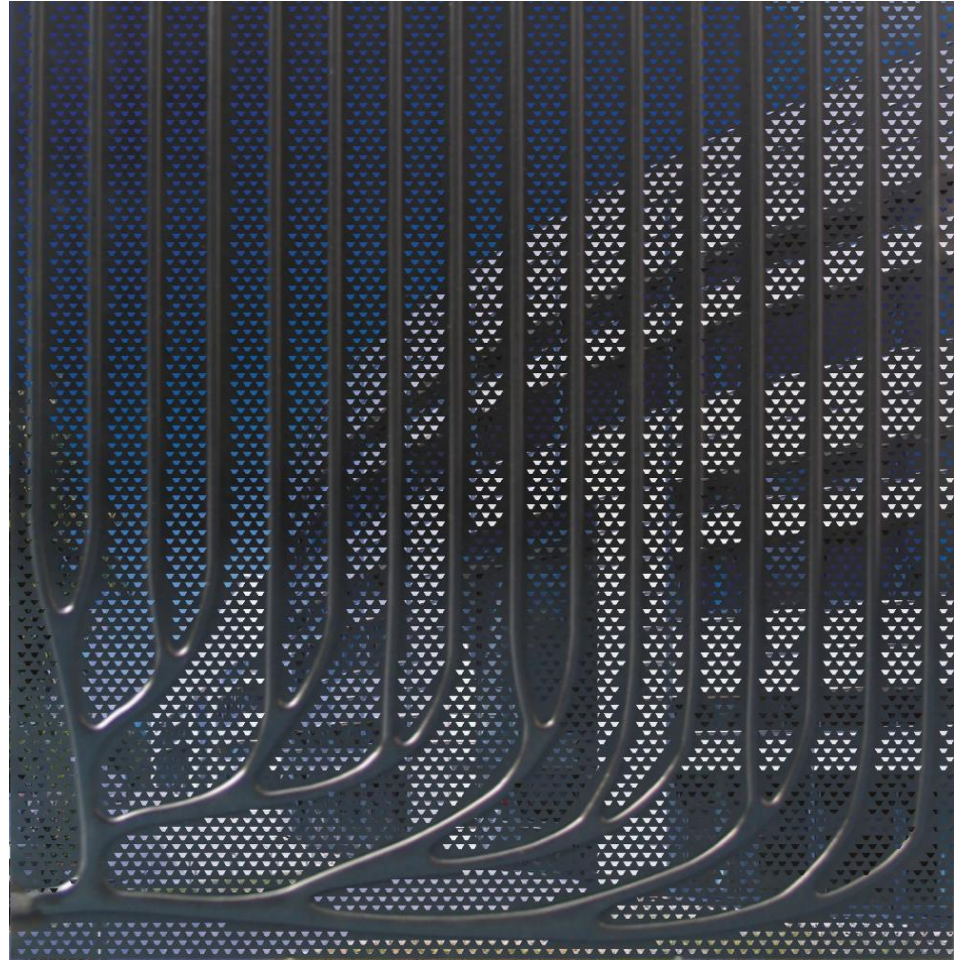
Fraunhofer patent as starting point for research projects

Transparent Solar Thermal Facade Collector (Colombra®)



Multifunctionality

- solar thermal energy
- visual contact
- solar control
- glare control
- daylighting



Virtual image of transparent solar thermal collector

© Fraunhofer ISE

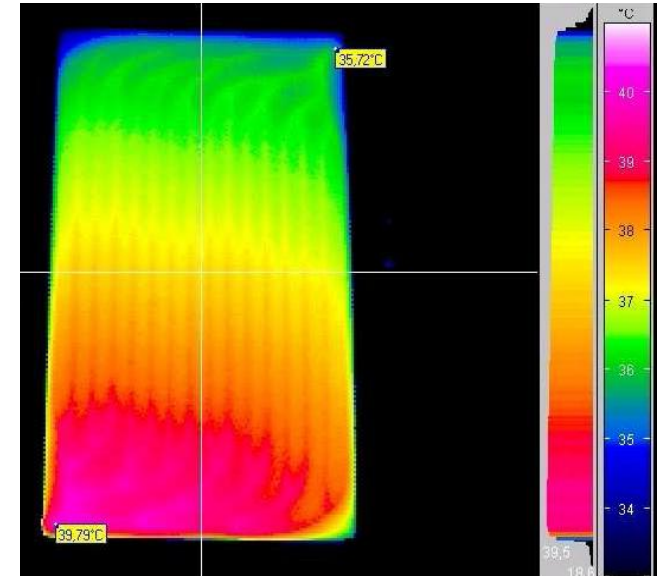
Fraunhofer patent as starting point for research projects



FracTherm® algorithm



FracTherm® solar absorber
in collector housing



Thermographic image after inflow
of warm water

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 - transparent BIPV system
 - concentrating PV-system

Fraunhofer patent as starting point for research projects

Multifunctional BIPV glazing

- **solar electricity**
(high efficiency for irradiation coming from above the horizon)
- **visual contact**
(horizontal or downwards)
- **solar control**
(g-value $g < 0.10$)
- **glare control**
(Daylight Glare Probability $DGP < 0.30$)

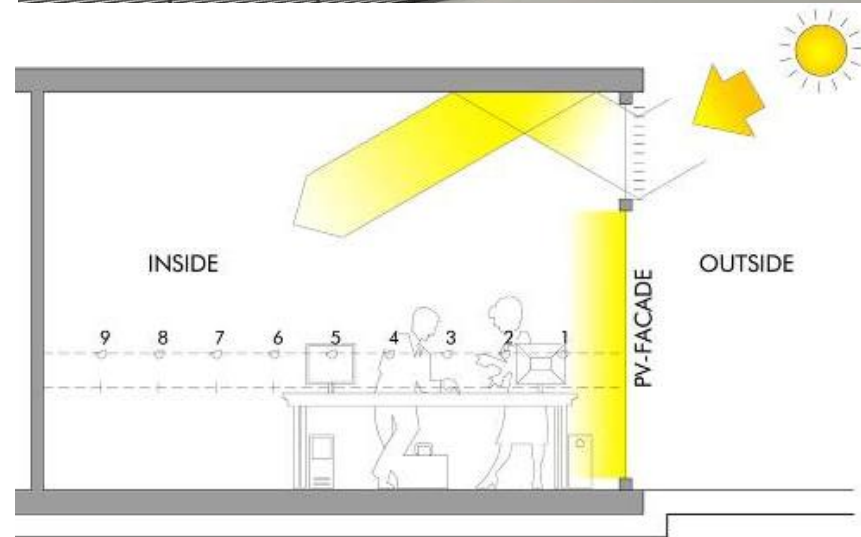


Visual mock-up for new BIPV component
Photos © Fraunhofer ISE

Fraunhofer patent as starting point for research projects

Multifunctional BIPV glazing

- **Example for installation**
the new device is especially useful for large open spaces



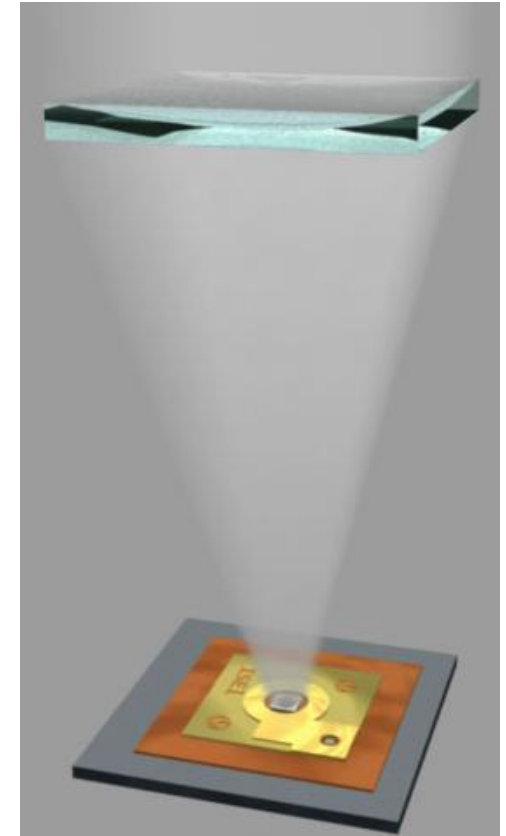
virtual images © Fraunhofer ISE

Spin-Off Company



FLATCON™ Module

Fresnel Lens All-Glass
Tandem Cell Concentrator



2005 – 2006 Spin-Off Company launched

Fraunhofer as shareholder

Exclusive license from Fraunhofer

Fraunhofer venture group gave support

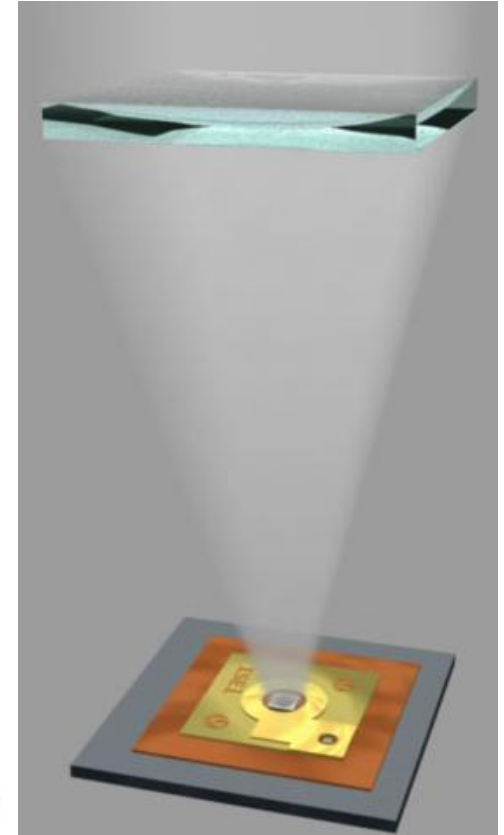
Sep '04 Decision for founding
of a spin-off company

Feb '05 Company founded

Jun '05 First Demo-System
installed

Feb '06 Series A financing
round

Aug '06 Pilot production line in
operation



2005 – 2006 Spin-Off Company launched

Fraunhofer builds pilot production line in R&D project

Concentrix rents pilot production line for first prototypes

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Pilot production line for FLATCON Modules

2007 – First field installs

Aug '07 First small power plant installed

Dec '07 Partnership concluded with Abengoa Solar



The first power plant installation in Spain was completed in summer 2007

2007 – First field installs

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Dec '07 Partnership concluded with Abengoa Solar



Abengoa Solar, one of the leading engineering companies in Spain and with world-class expertise in CSP, chose Concentrix as CPV partner and investment

2008 – Poised for growth

Jan '08 Innovation Award of the German Industry Association

Feb '08 First 100 kW installation completed

Dec '08 Inauguration of the first 25 MW production line



Sieger der Kategorie Start-up: Concentrix Solar GmbH, Freiburg



2008 – Poised for growth

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Completion of the first 100 kW installation in Spain.



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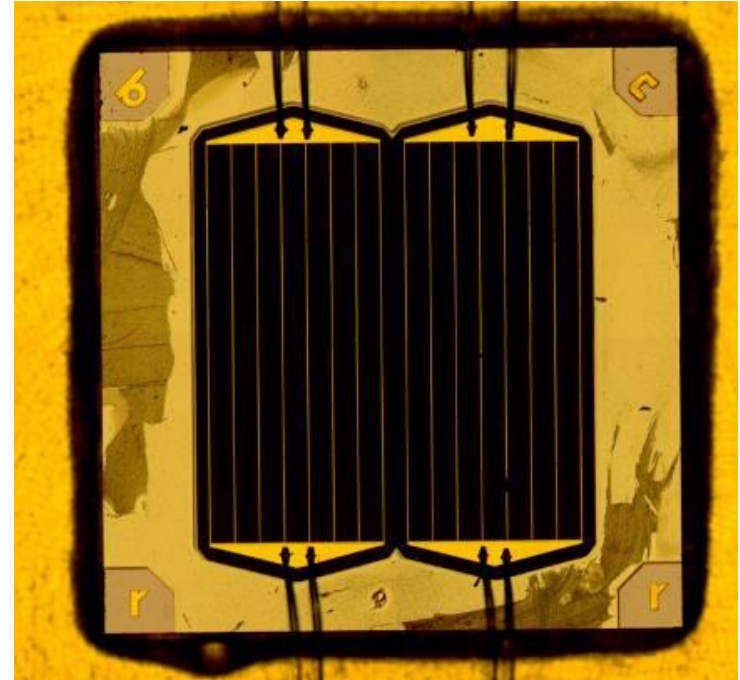


Inauguration of the first 25 MW production line



World Record Solar Cell at Fraunhofer ISE

- **41.1 % Efficiency**
@ C=454 suns
- Cell area = 5.09 mm²
- Ga_{0.35}In_{0.65}P/Ga_{0.83}In_{0.17}As/Ge metamorphic multi-junction solar cell



January 13, 2009:
41.1 % efficiency