

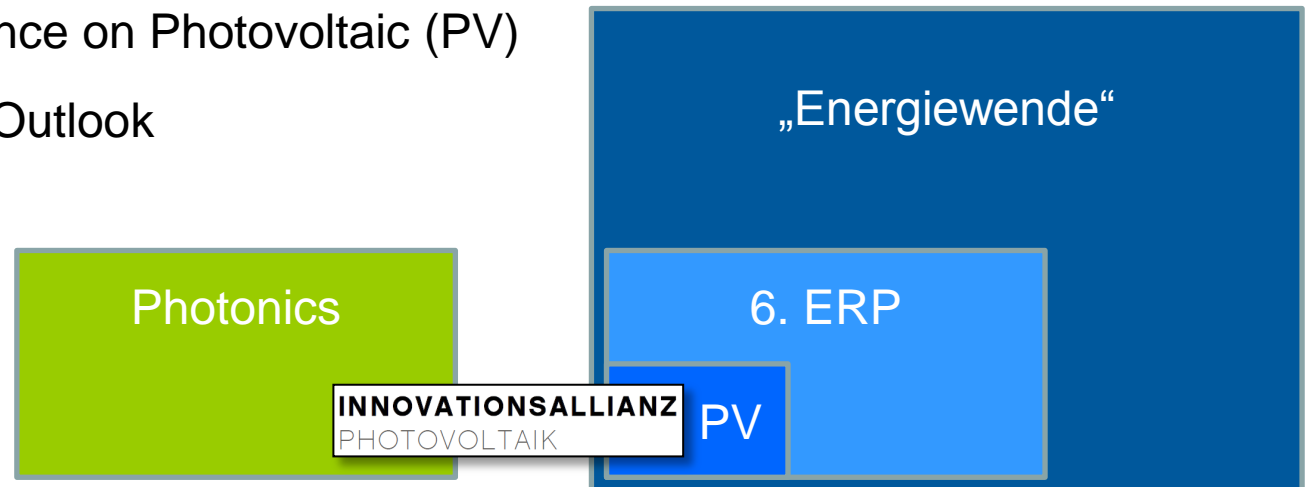


› **Forschen im Verbund: die deutsche Forschungsförderung**

Paris, 14. November 2013

Agenda

- „Energiewende“ – Targets und Framework set by the German Federal Government
- The 6. Federal Program on Energy Research
- R&D on PV: targets, budget and main focus
- Innovation Alliance on Photovoltaic (PV)
- Conclusions & Outlook



„Energiewende“

Targets und Framework set by the German Federal Government

Until 2050, Germany's energy supply should be generated primarily from renewables.

The Energy Concept of 28 September 2010 and the decisions on accelerating the energy transformation of summer 2011 describe the road towards the new energy era with specific targets, a monitoring process and a sound financing plan, as well as around 180 individual measures.

Targets

- **Greenhouse gas emissions** are to be reduced
- Faster **expansion of renewable energies**, and integration of renewable energies into the overall energy system
- Primary energy and electricity **consumption** is to fall
- **Energy productivity** is to rise, i.e. heat demand in buildings is to be reduced

„Energiewende“

Targets und Framework set by the German Federal Government

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Measures (on renewable energies)

- Renewable Energy Sources Act (EEG)
- Act on the Promotion of Renewable Energies in the Heat Sector (Heat Act, EEWärmeG)
- Biomass Ordinance (BiomasseV)
- ...
- The 6. Energy Research Program

The 6. Energy Research Program

Institutional Funding
of BMBF, BMWi, BMELV

Project funding

BMWi: Energy saving and energy efficiency
Nuclear safety and repository research

BMU: **Renewable energies** except bioenergy

BMELV: Bioenergy

BMBF: Basic research in energy efficiency and on renewable energies
Nuclear Safety and final disposal research
Fusion research



The 6. Energy Research Program

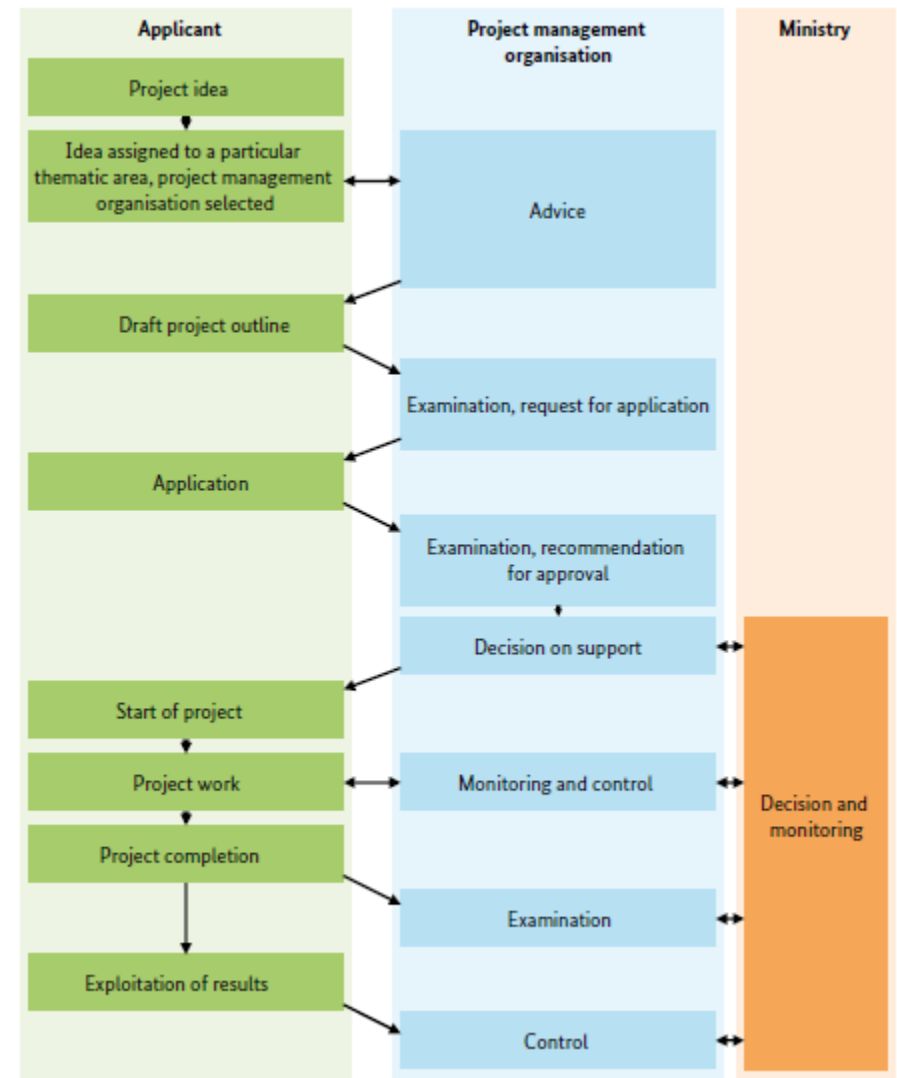
The **project funding** is based on applications for fixed-term projects mainly in competitive procedures.

Since 2006, the research and innovation policy has been aligned to the principles of the **High-Tech Strategy for Germany (HTS)**. This represents a comprehensive national innovation strategy with which the existing scientific-technical competences are summarized and specifically expanded.

The follow-on High-Tech Strategy 2020 focuses on current and future challenges in Germany and across the world and identifies **five demand fields**:

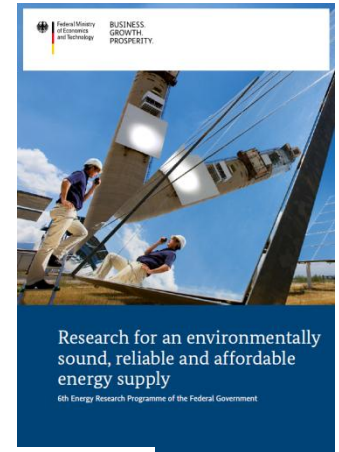
climate/energy,
mobility,
communication.

health/nutrition,
security and

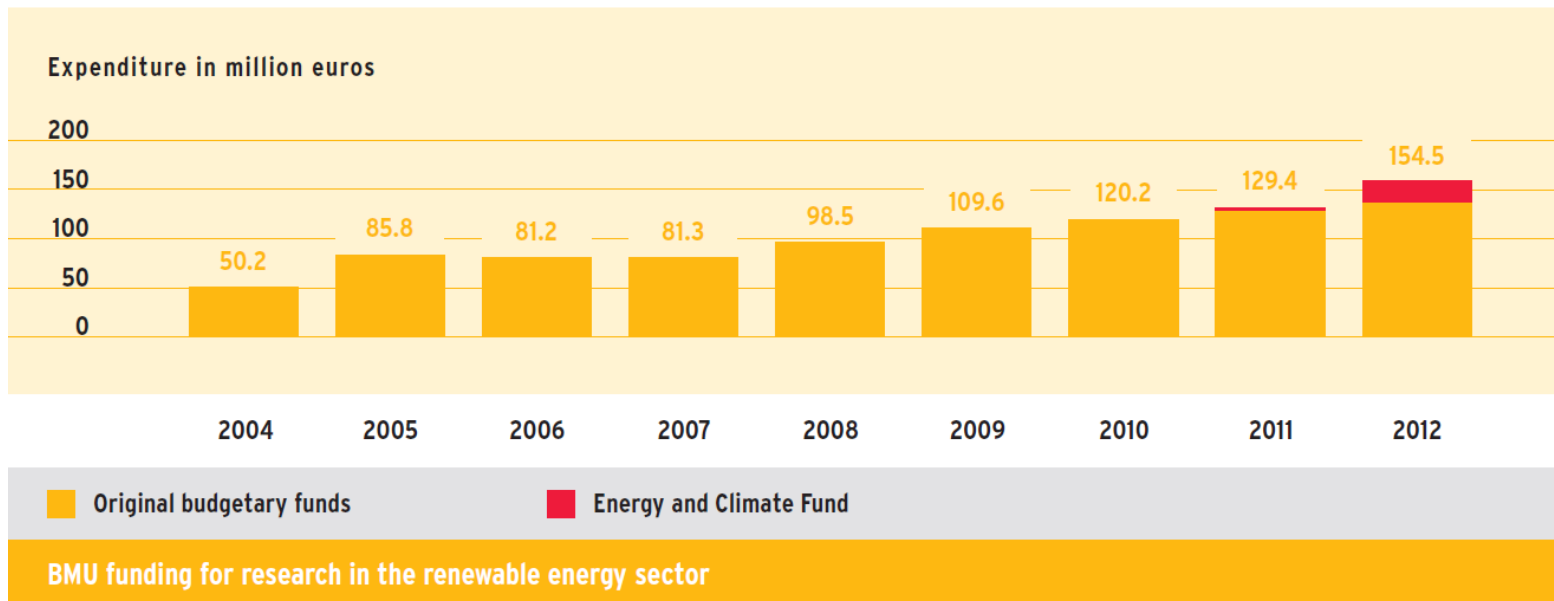


The 6. Energy Research Program

BMU expenditure on R&D for renewable energies

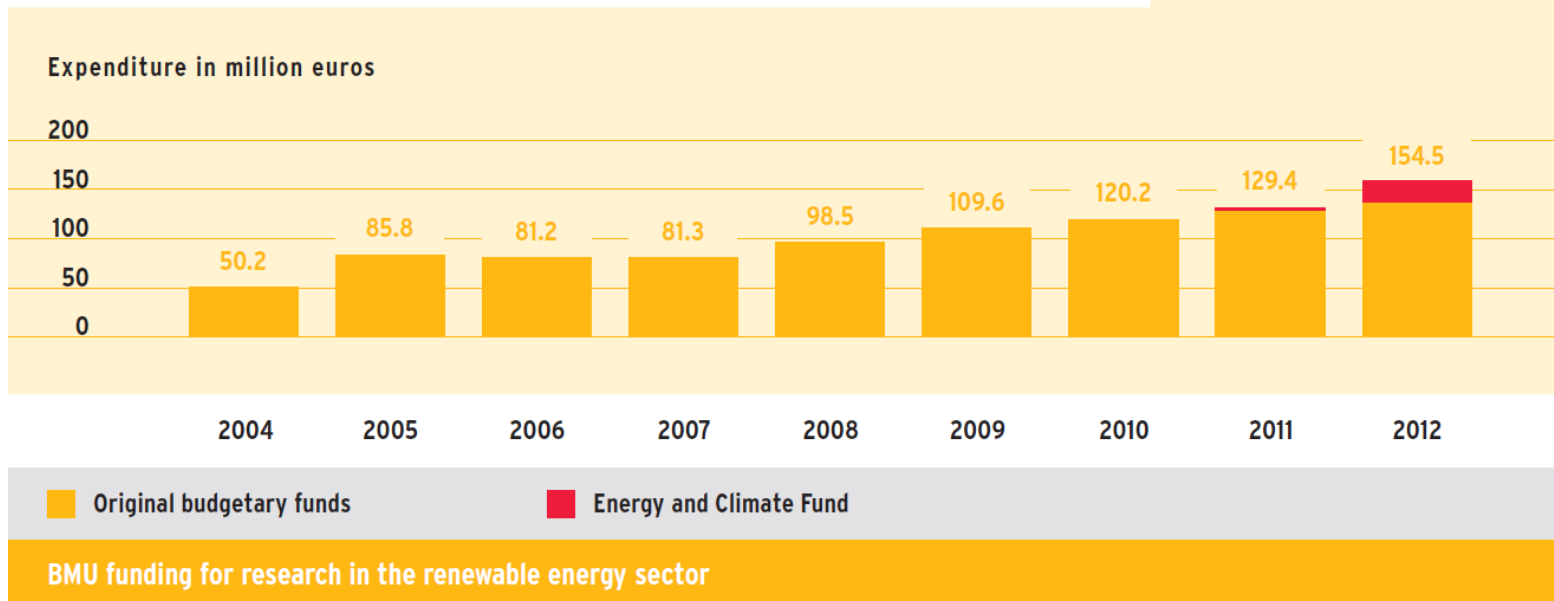
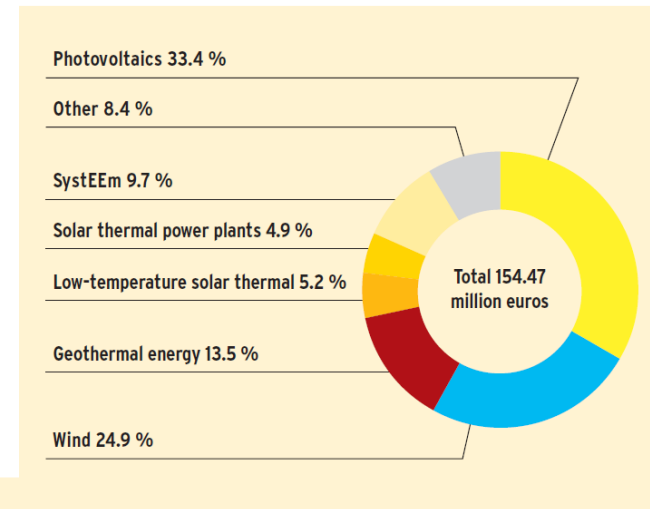


Source: BMU



The 6. Energy Research Program

BMU expenditure on R&D for renewable energies



R&D on PV: targets, budget and main focus

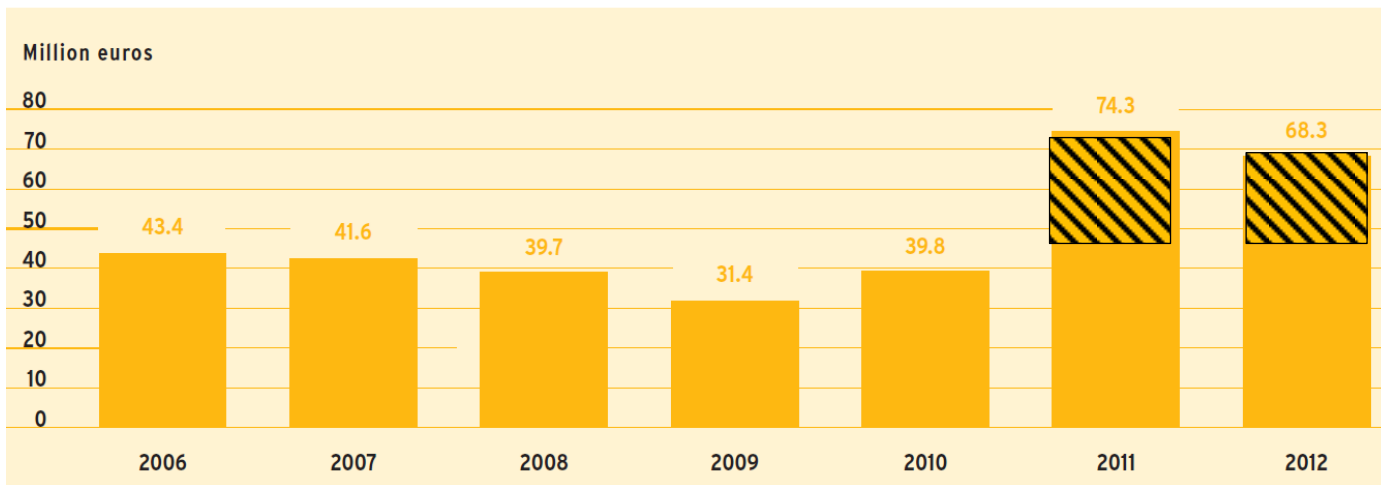


Targets:

- reduction of production costs / systems costs
- development of high quality products
- build the basis for domestic manufacturing of innovative products

Focus on innovation oriented research -
but struggling with closures of business and insolvencies

Source: BMU



INNOVATIONSALLIANZ
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R&D on PV: targets, budget and main focus

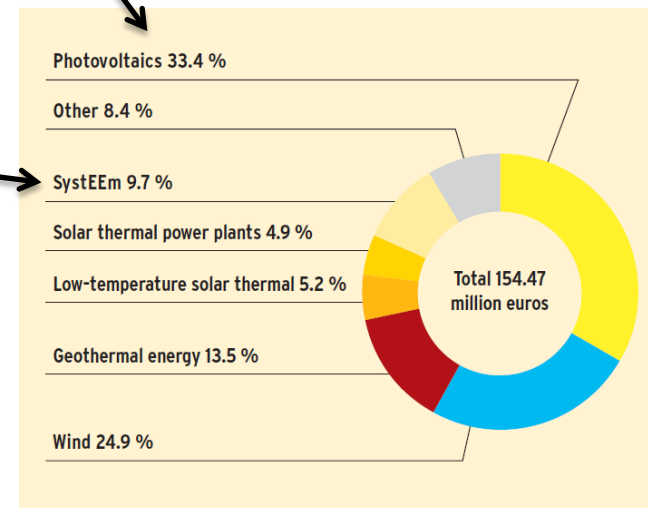


Technical Topics:

- crystalline Silicon
- thin film technologies, especially CIGS
- concentrating PV (CPV)
- power electronics (inverter, ...)

not under the BMU PV umbrella

- System Integration
- OPV, new concepts -> BMBF

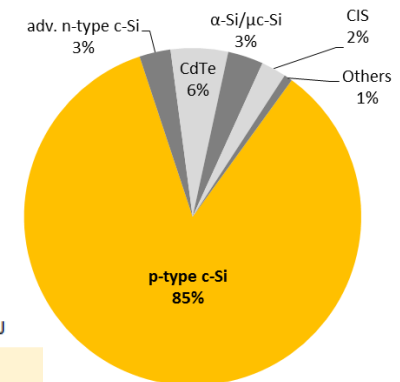


R&D on PV: targets, budget and main focus

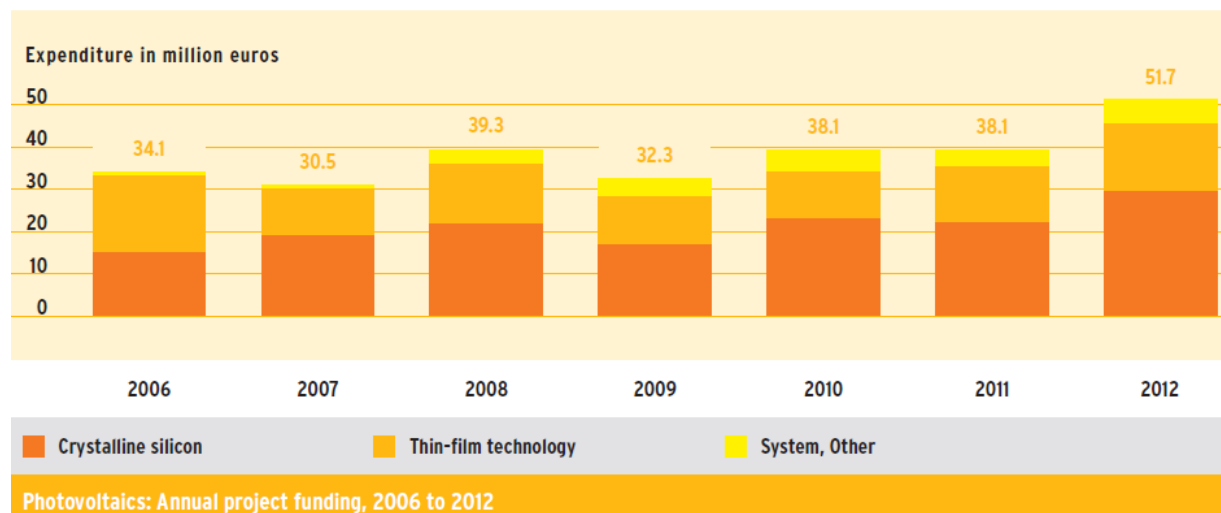


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- crystalline Silicon
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- concentrating PV (CPV)
- power electronics (inverter, ...)



Source: BMU



of different cell technologies in 2011 (Photon, 04/2012)

Innovation Alliance on Photovoltaic (PV)

INNOVATIONSALLIANZ
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Innovation Alliances represent a new instrument for research and innovation policy within the framework of the High-Tech Strategy initiated by the Federal Ministry of Education and Research (BMBF). Alliances are arranged with respect to specific application areas or future markets. They exercise a particular economic leverage effect. Currently, there are nine Innovation Alliances created by the Government, the scientific community and industry.

Innovation Alliances are the first instrument which involves an executive-level commitment by industry regarding additional investments.

The Federal Government aims to provide one euro for every five euros paid by industry.

It is important that the right priorities are set in this process, for example in the area of climate protection and energy: the Innovation Alliances make a substantial contribution

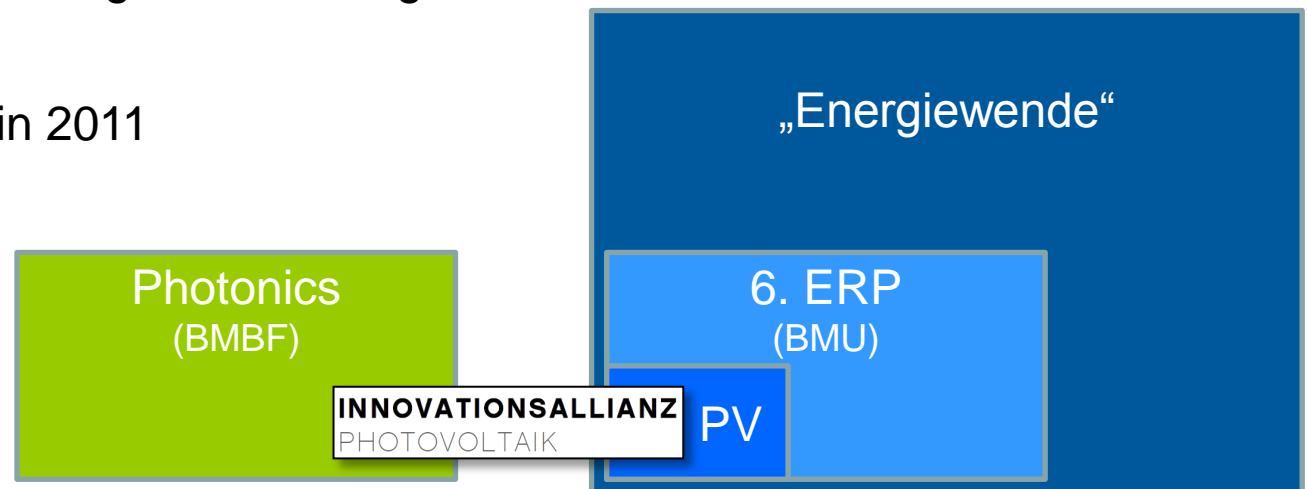
- to energy-efficient lighting (OLED initiative),
- to the use of renewable energy (organic photovoltaics / (anorganic) **photovoltaics**) and
- to energy storage (lithium-ion battery).

Innovation Alliance on Photovoltaic (PV)

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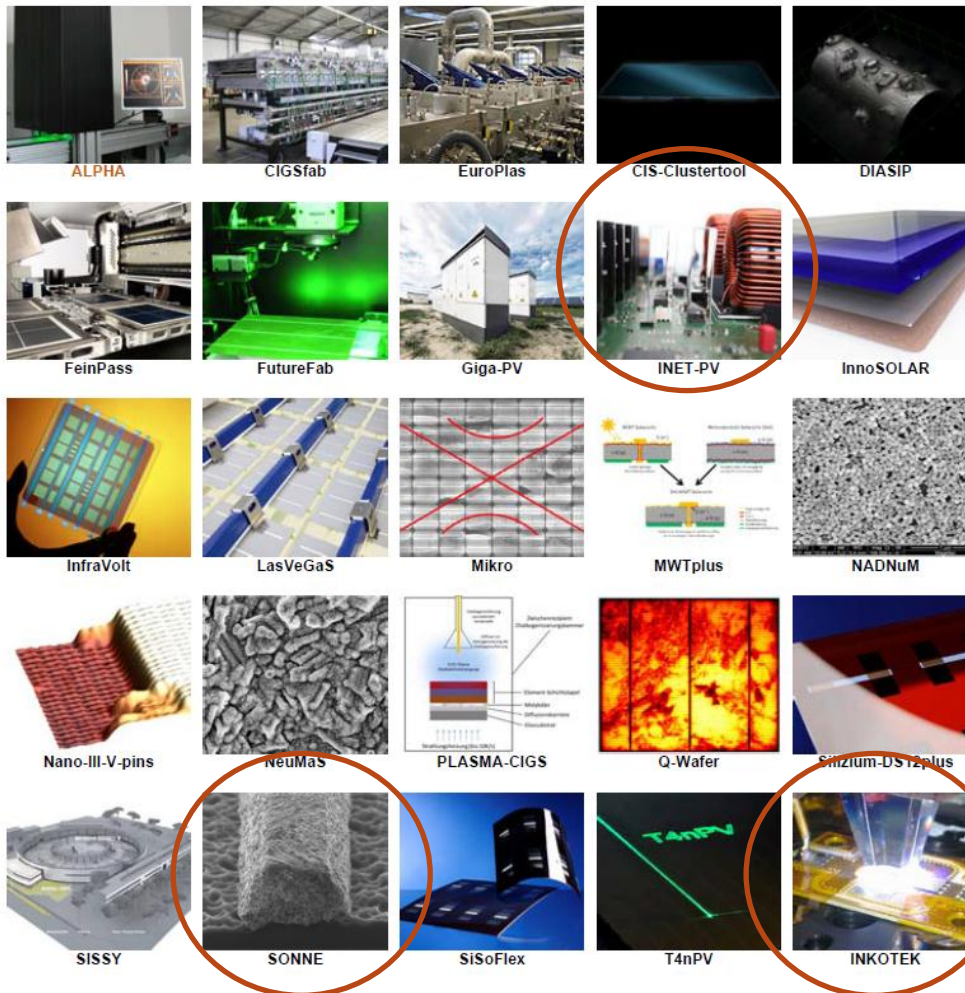
- established in 2010
- federal funding up to 100 mill. € (BMU and BMBF 50 mill. € each)
- solar industry committed to spend 500 mill. € to implement results
- roughly additional 260 mill. € already spend by solar industry between start of the Alliance and autumn 2012
- (mainly) industry driven projects, co-operative research
- average federal funding ~ 50% of eligible costs

- 25 projects, start in 2011



Innovation Alliance on Photovoltaic (PV)

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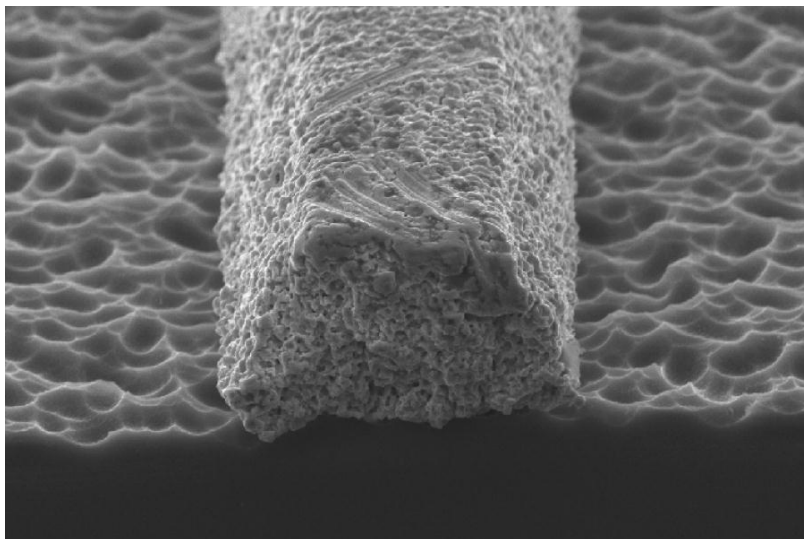
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SONNE

- increase power of Silicon modules from 250W to 300W
- reduce costs of solar electricity by a factor of 3

Activities:

- develop highly efficient solar cells ($\eta \geq 20\%$ on cz-Si)
- minimize electrical losses by new string technology
- minimize optical losses by new AR coating of the module glass
- module lifetime up to 30 years, low annual degradation



Volume: 21,5 mill. € (53%)

Period: 01.01.11 – 31.12.13

Partner: 11 companies, 4 research institutes

- SolarWorld Innovations GmbH, Freiberg (Koordination)
- Solar Factory GmbH, Freiberg
- Hochschule Mittweida
- Momentive Performance Materials GmbH, Leverkusen
- Fraunhofer-Institut für Solare Energiesysteme (ISE), Freiburg im Breisgau
- Berkenhoff GmbH, Heuchelheim
- SITEC Solar GmbH, Neuruppin
- Solar Factory GmbH, Freiberg
- RENA GmbH, Gütenbach
- Technische Universität Chemnitz
- KUKA Systems GmbH, Augsburg

Innovation Alliance on Photovoltaic (PV)

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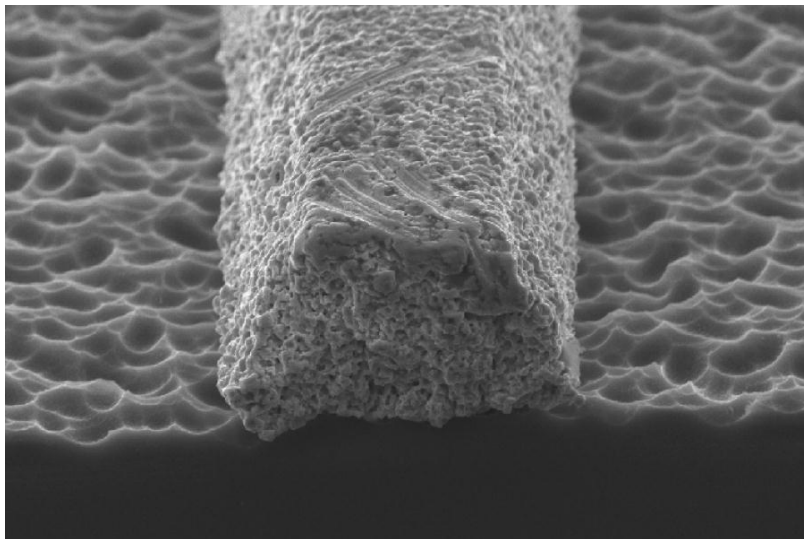
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- module lifetime up to 30 years, low annual degradation

Results:

- PERC cells with $\eta \sim 20\%$
- +6 W
- +5 W
- ongoing



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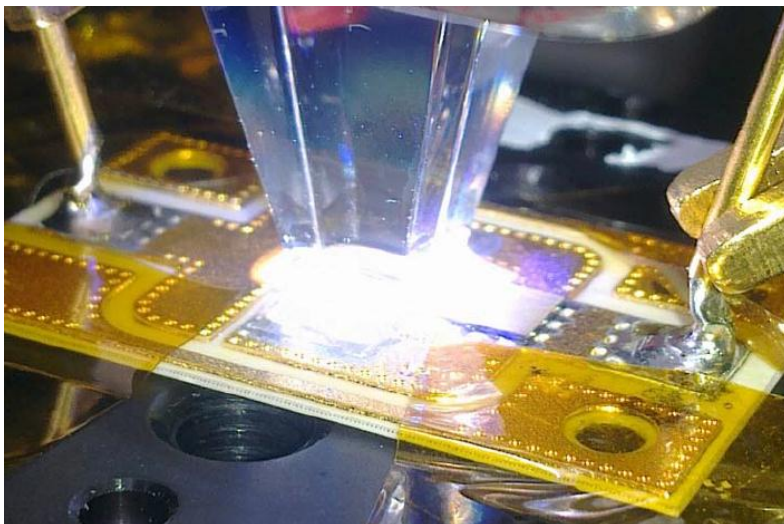
Innovation Alliance on Photovoltaic (PV)

INNOVATIONSALLIANZ
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- INKOTEK**
- reduce production costs of solar cells for Concentrating PV (CPV) by 40%

Activities:

- modified substrates
- deposition technology
- assembly of device
(cell, circuit board, secondary optics)



Volume: 6,4 mill. € (50%)
Period: 01.10.11 – 30.09.14
Partner: 6 companies, 1 research institute

- AZUR SPACE Solar Power GmbH, Heilbronn (Koordination)
- Photonic Sense GmbH, Eisenach
- Philipps-Universität Marburg
- Sempa Systems GmbH, Dresden
- CS Clean Systems AG, Ismaning
- Dausinger + Giesen GmbH, Stuttgart
- Concentrator Optics GmbH, Cölbe

Innovation Alliance on Photovoltaic (PV)

INNOVATIONSALLIANZ
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INKOTEK

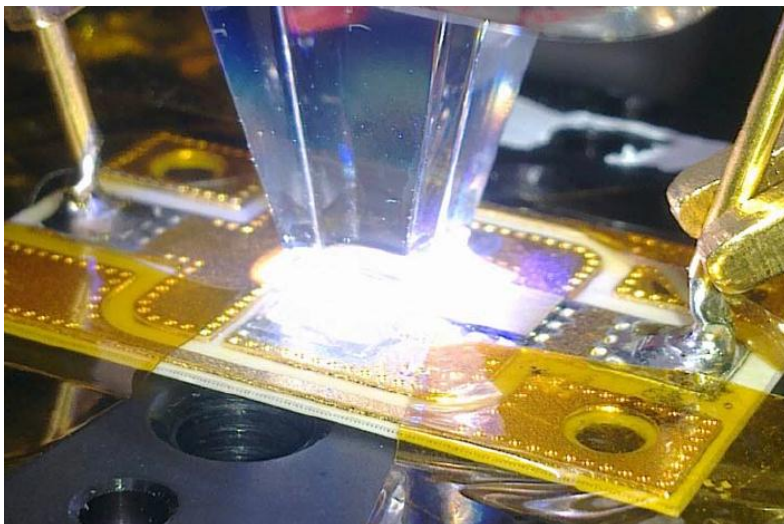
- reduce production costs of solar cells for concentrating PV (CPV) by 40%

Activities:

- modified substrates
- deposition technology
- assembly of device
(cell, circuit board, secondary optics)

Results:

- usage of Ge substrates
- $\eta > 43\%$ (@500x)
- new low cost secondary optic developed



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Period: 01.10.11 – 30.09.14

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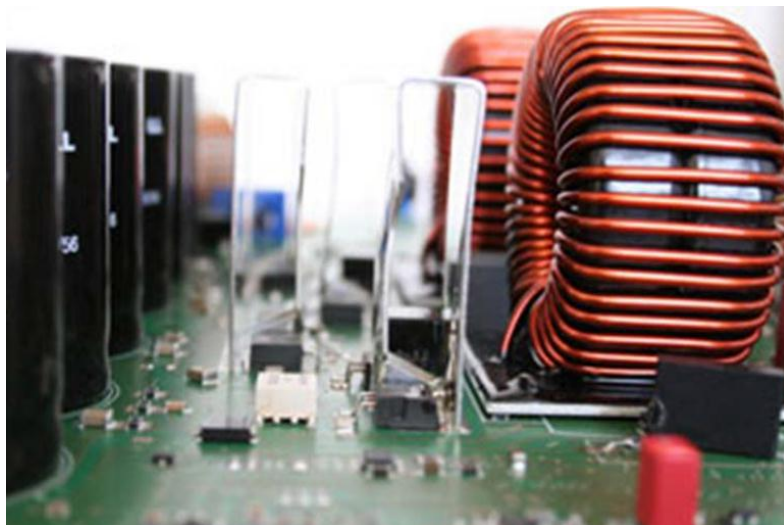
Innovation Alliance on Photovoltaic (PV)

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- INET-PV**
- new inverter technologies for small PV systems (5 kW)
 - with DC/DC converter for battery management

Activities:

- new topology for a 3-phase inverter of 5 kW
- introduction of innovative semiconductor devices (SiC) to
 - raise inverter efficiency (> 99%)
 - lower inverter costs



Volume: 3,0 mill. € (43%)
Period: 01.12.11 – 30.11.14
Partner: 1 company, 2 research institutes

- Steca Elektronik GmbH, Memmingen (Koordination)
- Fraunhofer-Institut für Solare Energiesysteme (ISE), Freiburg im Breisgau
- Hochschule Kempten

Innovation Alliance on Photovoltaic (PV)

INNOVATIONSALLIANZ
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INET-PV

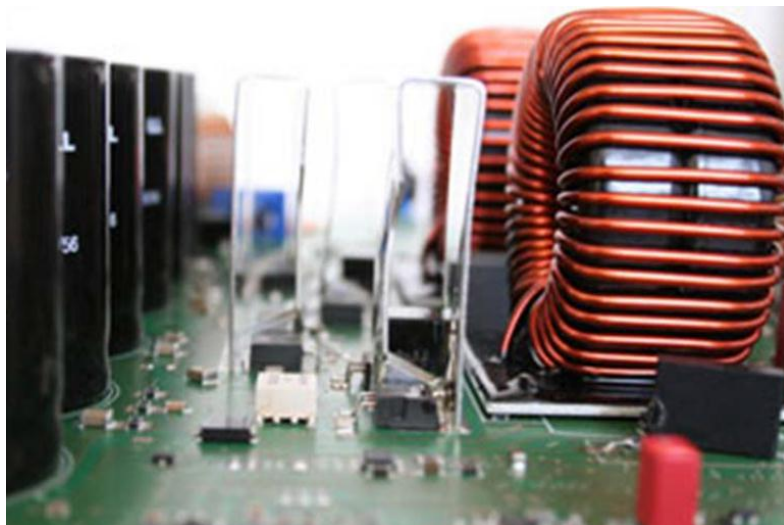
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Activities:

- new topology for a 3-phase inverter of 5 kW
- introduction of innovative semiconductor devices (SiC) to
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Results:

- basic design fixed
- devices specified
- first prototype in lab test



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Conclusions & Outlook

- R&D on PV is part of the measures contributing to the German „Energiewende“
- The focus of BMU funding is on innovation oriented research under industrial leadership – taking into account the current problems of the German/European PV industry
- Innovation Allianz PV brings together different actors, especially from industry, and makes know how of research institutes available
- Innovations Allianz rises investments additionally to the actual funded projects
- BMU will continue funding of PV R&D with focus on the utilization of results in industry
 - Call for proposals “Research and Development on PV” of Mai 2013, evaluation of proposals ongoing
 - Participation in the European Solar-ERA-Net, first call of February 2013, evaluation of proposals ongoing

Conclusions & Outlook

for further reading

