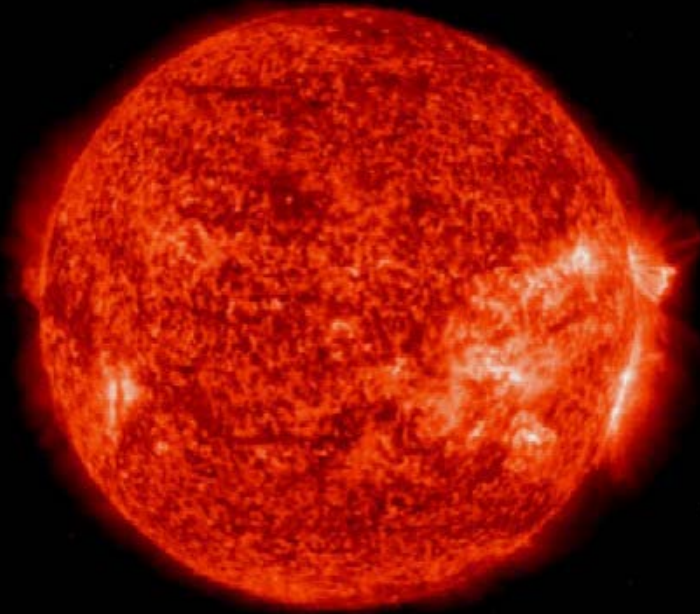




Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Bundesamt für Energie BFE
Office fédéral de l'énergie OFEN
Ufficio federale dell'energia UFE
Swiss Federal Office of Energy SFOE

The Swiss PV Research Programme



June 30, 2011 - SLN Workshop

Stefan Oberholzer BFE



Energy Research as an important pillar of energy policy: recent statements



Mai 25, 2011: Federal Council in its new energy strategy

«The restructuring of the energy system needs to be supported by the strengthening of energy research...»

«A plan of action on 'Coordinated Energy Research Switzerland' with relevant roadmaps should be drawn up for efficiency enhancing technologies, power grids and the storage and distribution of electricity. The necessary federal funding for pilot schemes and demonstration facilities should also be provided...»



Political initiatives: «good news»

June 2011: National Council

Postulat Chopard-Acklin 10.3080:

Fotovoltaik-Forschung. Stärkung und Abstimmung auf Industriebedürfnisse
accepted (148/33)

Motion Bäumle 11.3456:

Förderung erneuerbarer Energien ohne KEV-Deckelung
accepted

Motion Riklin 10.3142: **Beteiligung der Schweiz am Strategic Energy
Technology Plan der EU**

accepted

...

Federal Councillor Burkhalter (SoZ 19.6.11):

20.5 Mio. CHF for PV-Research Centre at CSEM (Neuchâtel) for 5 years



SFOE Energy Research Programmes

The SFOE is responsible for the co-ordination of the programmes, and is supported by federal, cantonal and municipal authorities. Implementation is carried out at cantonal universities, the Federal Institutes of Technology, universities of applied sciences, engineering and industrial companies, and the energy industry.

Renewables

- Biomass
- Wood
- Hydrogen
- **Photovoltaics** (> 25 years)
- Solar heat
- Geothermal energy
- Wind
- CSP
- Hydropower

Nuclear

- Regulatory safety research
- Nuclear technology and safety
- Nuclear fusion
- Nuclear waste

Energy efficiency

- Buildings
- Transports
- Accumulators and supercapacitors
- Grids
- Process engineering
- Electricity technology and applications
- Fuel cells
- Heat pumps, cogeneration, refrigeration
- Power plant 2020 / CCS
- Combustion

Others (horizontal)

- Energy policy fundamentals
- Knowledge and technology transfer
- Dams



PV Research Programme

Objectives of the photovoltaics programme are defined in the energy research concept 2008 – 2011 of the Federal Energy Research Commission (CORE)

Main goals for period 2008 – 2011:

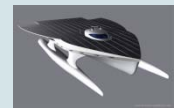
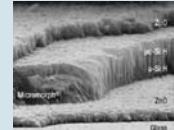
- Lowering the costs (module and systems)
- Increase the efficiency of solar cells (technology specific)
- Lowering material and energy input
- Simplification and standardisation of electrical system technology
- Increase of availability and variety of industrial products





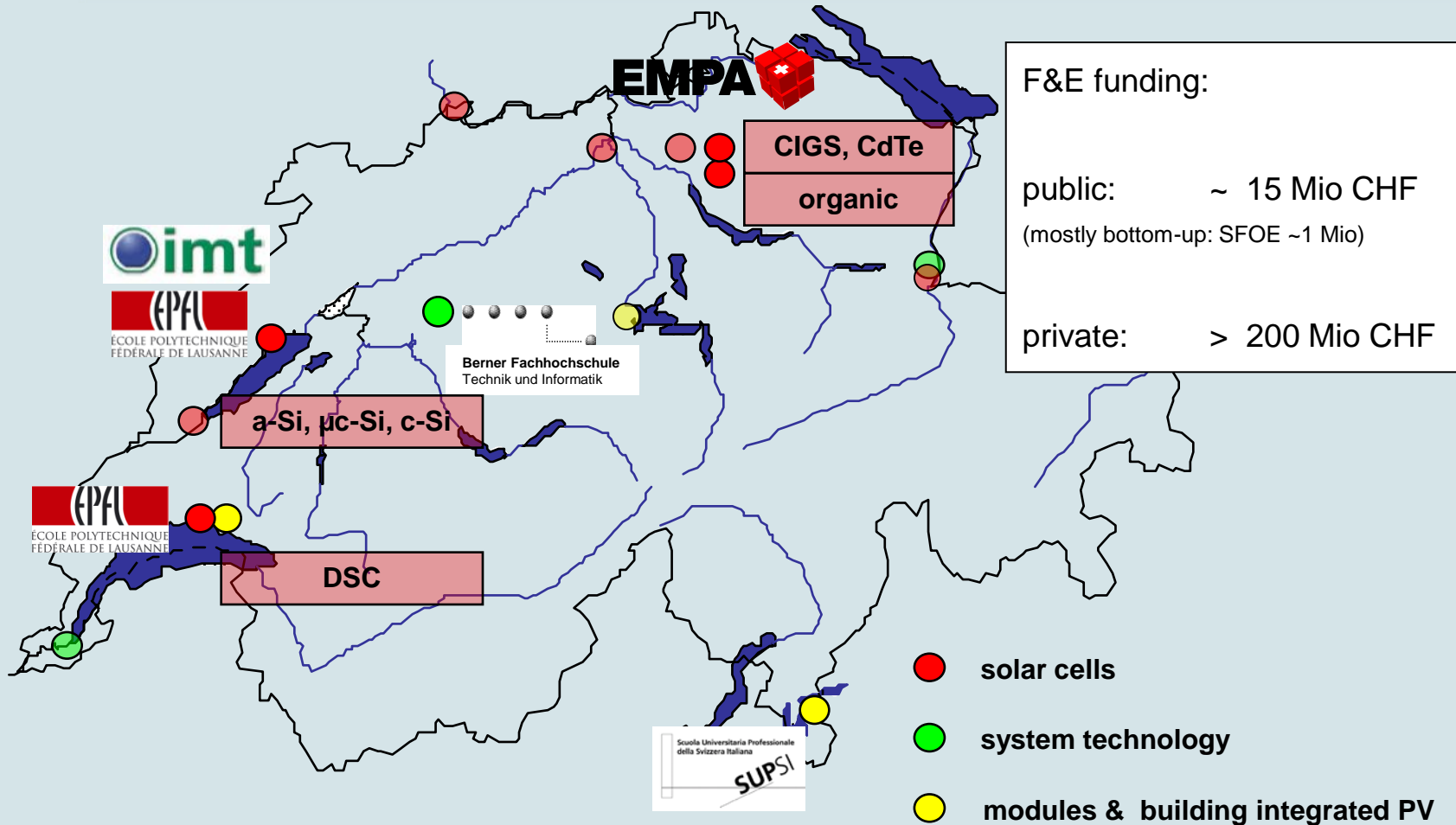
Priorities of the PV Research Programme

- Solar cells
- Solar modules and integration into buildings
- Electrical systems technology
quality assurance, certification of products (inverters),
integration in the grid
- Related topics
instruments for planning and monitoring, environmental aspects, combining
photovoltaics with other form of energies (electric cars ...)
- Institutional co-operation at the international level
EU PV-Technology Platform, PV ERA-NET, IEA PVPS, SEII



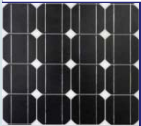



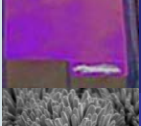



PV competences in Switzerland





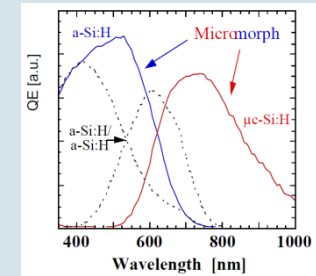
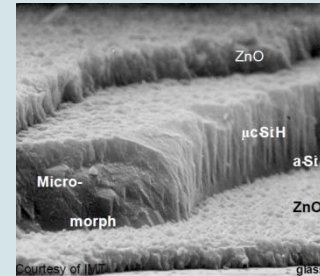
Solar cells: technologies in Switzerland

	Technology	Actors	R&D	Transfer	Industry
	c-Si	EPFL (IMT) EMPA	x	x	xxx
	Thin-film silicon	EPFL (IMT)	xxx	xxx	xxx
	CIGS, CdTe	EMPA	xx	x	x
	Dye-sensitized solar cell	EPFL (LPI)	xx	x	
	Organic solar cells	EMPA, ZHAW, CSEM	xx		
	ETA-cells	EMPA	x		

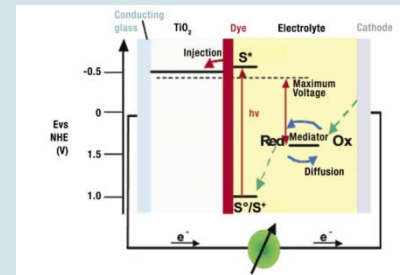


Solar cells: Swiss specialities

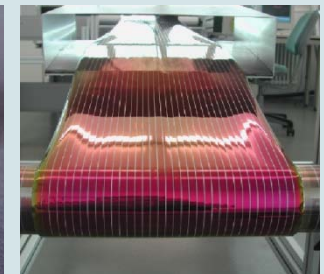
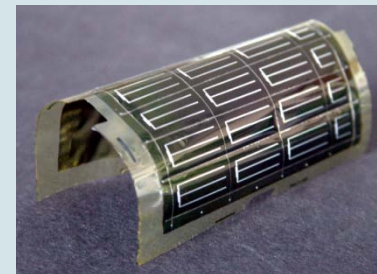
- Micromorphous silicon thin film solar cell



- Dye sensitized solar cell (Grätzel-cell)



- Solar cells on flexible substrates (CIGS, amorphous silicon)



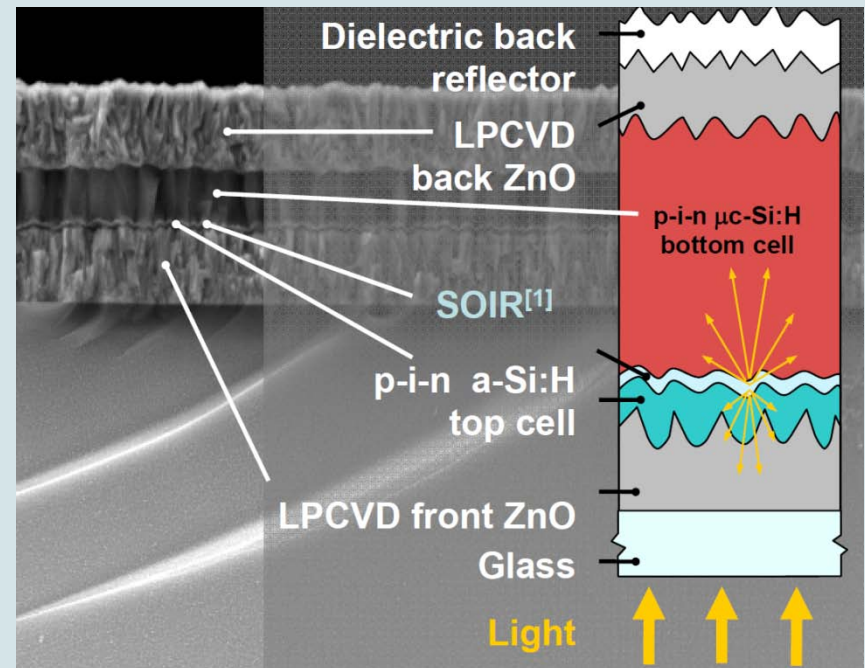


Solar cells: Swiss specialities

High-efficiency p-i-n micromorph solar cells

Major achievement 2010 in the optimization of p- and n-doped nanocrystalline silicon oxides.

Their successful integration into single junction and multi-junctions cells combined with optimized zinc oxide electrode design and other improvements lead to the fabrication of micromorph tandem junction cells with new lab record efficiencies of **13.7% initial** and **11.5% stable**.



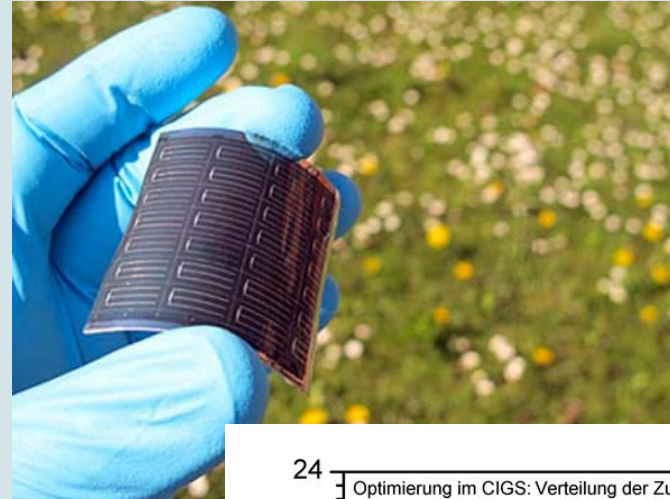
P. Buehlmann et al, APL. 91 (2007) 143505



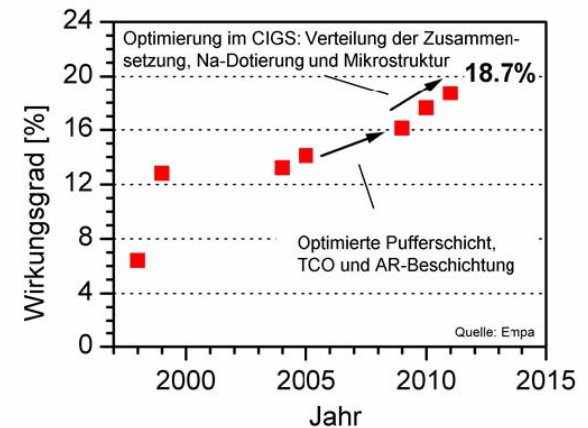
Solar cells: New approaches

Record efficiency of 18.7% for flexible CIGS solar cells

- polymer films used instead of metal foil (low temperature deposition)
- potential cost advantages in manufacturing, balance of system (roll-to-roll processing)
- certified by Fraunhofer ISE
- company Flisom to commercialize technology



May 19, 2011

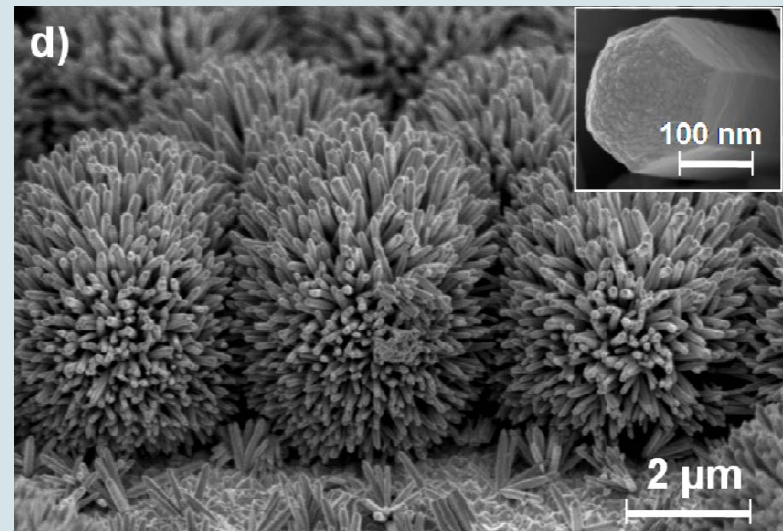
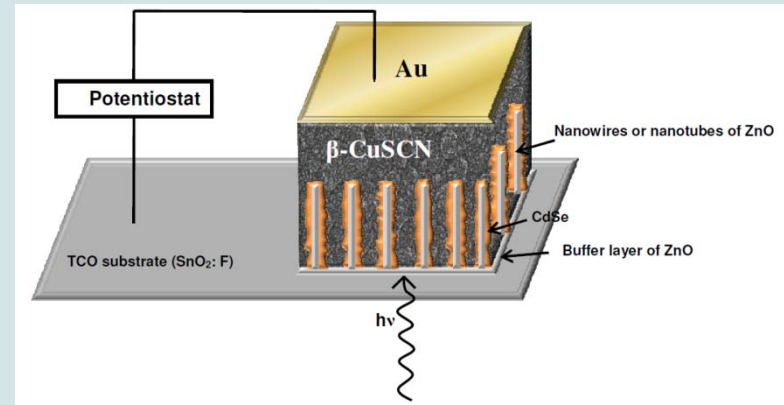




Solar cells: new approaches

Extremely Thin Absorber (ETA) cells

- conceptually close to dye-sensitized solar cells (dye replaced by CuInS_2 , CdSe or CdTe)
- inorganic \rightarrow stable
- enhanced light harvesting due to the surface enlargement and multiple scattering
- hollow urchin-like ZnO thin films by electrochemical deposition





Quality assurance of PV modules: ISAAC –SUPSI

- Module testing
 - Long term
 - Third parties
 - Energy rating
- Module certification
 - IEC standards
- Building integrated PV

www.bipv.ch





Quality assurance of PV inverters: HTI Burgdorf

- Inverter testing
 - Long term
 - Third parties
 - 100 kW simulator
- System analysis
 - High voltage
 - Lightning
 - Arc-detector
- PV plant analysis



www.pvtest.ch



PV research programme: Successes



swisselectric
research



The Swiss Photovoltaics R&D Programme
Stefan Oberholzer BFE



PV research programme: Limits and Interfaces

«Upstream»

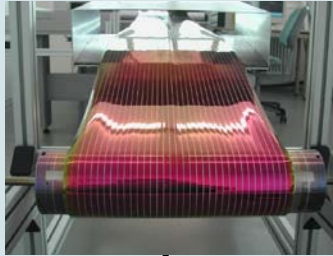
- Materials research
- Technology enablers

«Downstream»

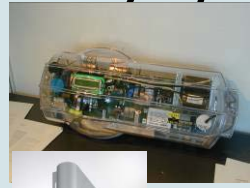
- Building technology
- Grid integration
- Energy storage
- Measurement technology



Swiss industry along the PV value chain



PVSYST



Solar Dach
Sarnafil



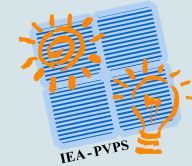
source:
NET AG

turnover 2010 > 2 billion CHF



PV research programme: International Collaboration

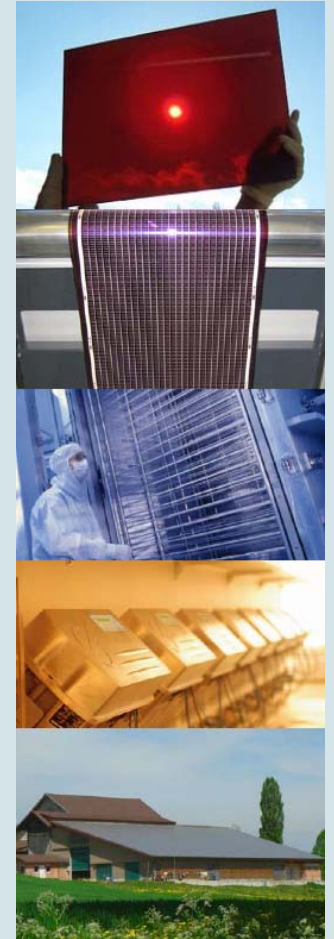
- IEA PVPS Programme
Task 1, Task 9, Task 12, Task 13, Task 14
www.iea-pvps.org
- PV-ERA-NET
Joint calls zwischen europäischen PV Programmen,
POLYMOL (2008), PV+ Grid (2009 – 2010)
www.pv-era.net
- EU PV Technology Platform
www.eupvplatform.org
- EU Set Plan: Solar European Industry Initiative (SEII)





Summary

- Swiss photovoltaics research and technology are at a high level when considered at an international scale.
- Good transfer of the results of Swiss photovoltaic research into industry
- Photovoltaics offers very interesting opportunities for Switzerland as technology and industry location
- Swiss photovoltaics industry is continuously increasing (mainly export)
- Home market conditions have to be improved to tap the potential of photovoltaics as renewable energy source for Switzerland





More information

annual report 2010:



www.bfe.admin.ch/forschungphotovoltaik
www.photovoltaic.ch

Contact:

Dr. Stefan Nowak (SFOE program manager)
stefan.nowak@netenergy.ch

Dr. Stefan Oberholzer (SFOE PV-research)
stefan.oberholzer@bfe.admin.ch