

Swiss PV research platform

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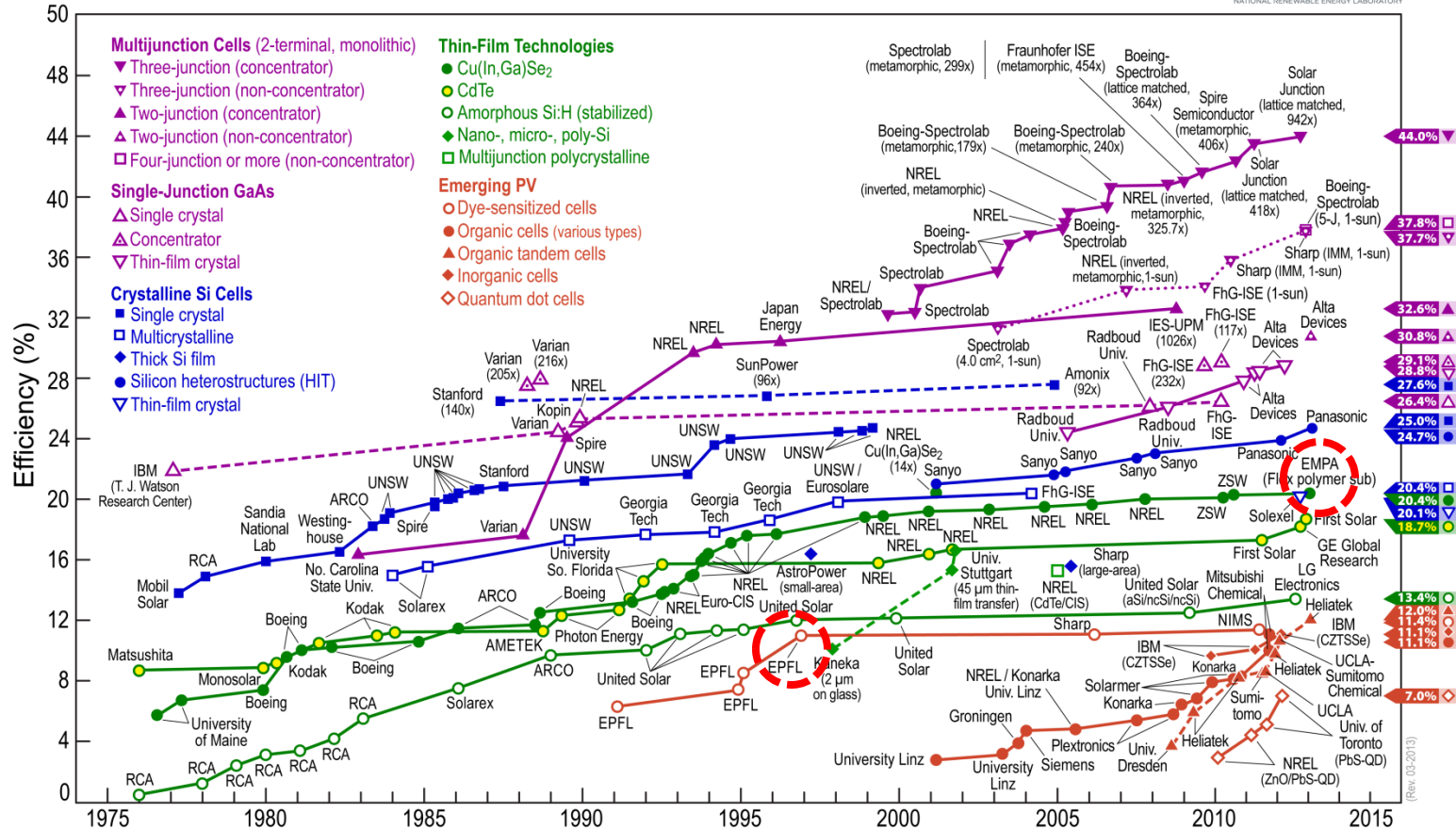
*EMPA – Materials Science
and Technology*

*Laboratory for
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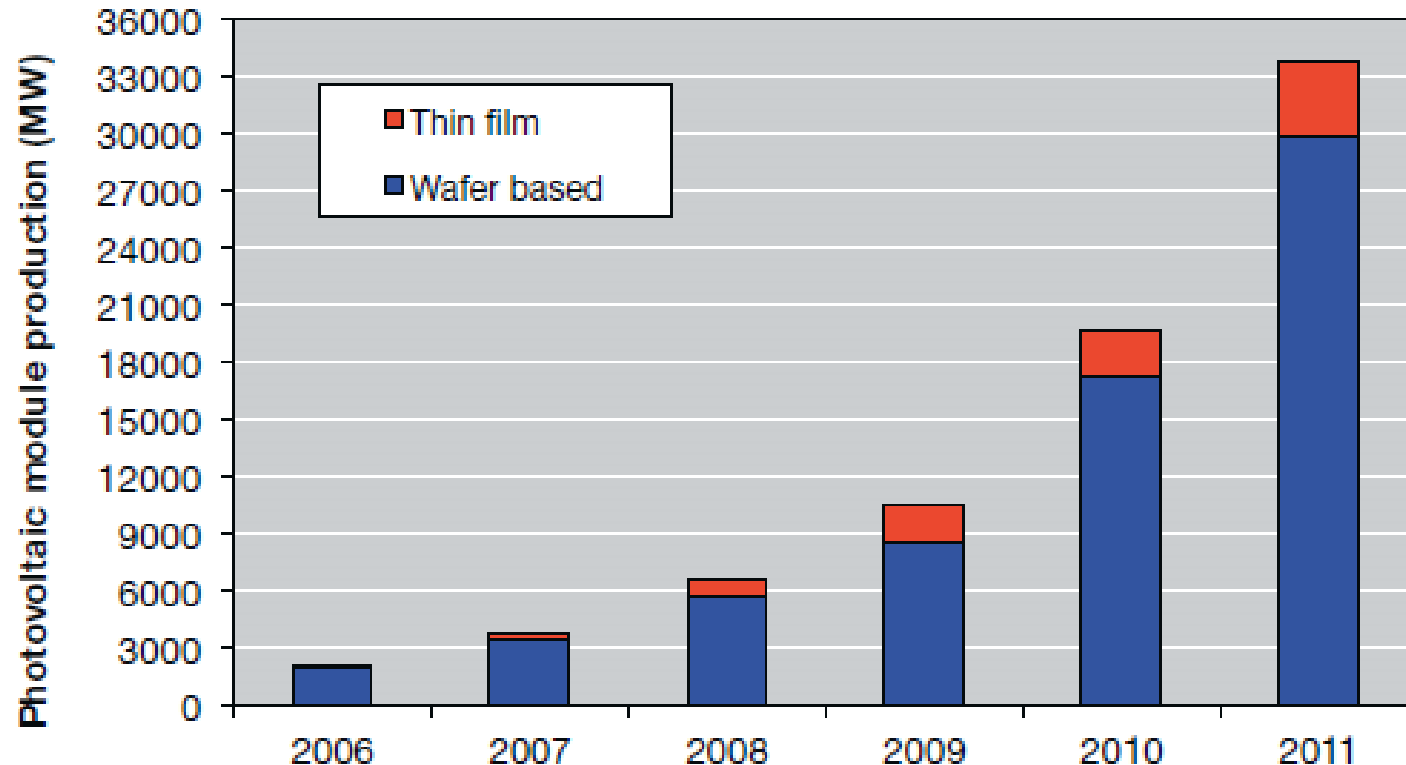
Switzerland, a small country with extraordinary impact – also in thin film PV

Best Research-Cell Efficiencies



Further record (2013) : 10.7% efficiency single-junction microcrystalline silicon solar cell (EPFL-PV Lab)

PV module production (reporting countries 2006 – 2011) – the future is low cost

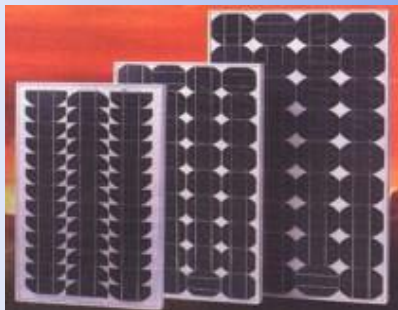


Trends in photovoltaic applications, Report IEA-PVPS T1-21:2012

Leading countries in 2011: *China (20 GW), Japan (2.7 GW), Germany (2.5 GW), USA (1.1 GW), Korea (1 GW).*

Different PV Generations

1. Generation Wafer based



- Absorber thickness:
~ 200 μm
- Limited wafer size
- Rigid and heavy
- Complicated module assembly
- Mature technology (85%)

Limited cost reduction potential

2. Generation Thin film on glass



- Absorber thickness:
< 3 μm
- Large area processing
- Rigid and heavy
- Monolithic construction
- Young technology (15%)

Medium cost reduction potential

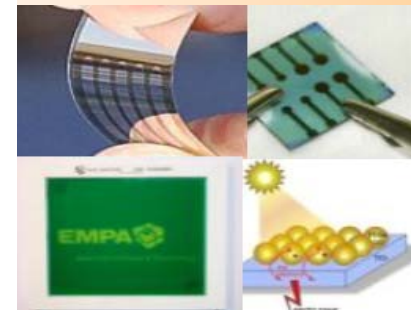
3. Generation Thin film on flex. foil



- Absorber thickness:
< 3 μm
- Large area R2R processing
- Flexible and lightweight
- Monolithic construction
- New applications and facile installation

High cost reduction potential

4. Generation OPV/DSC, new concepts



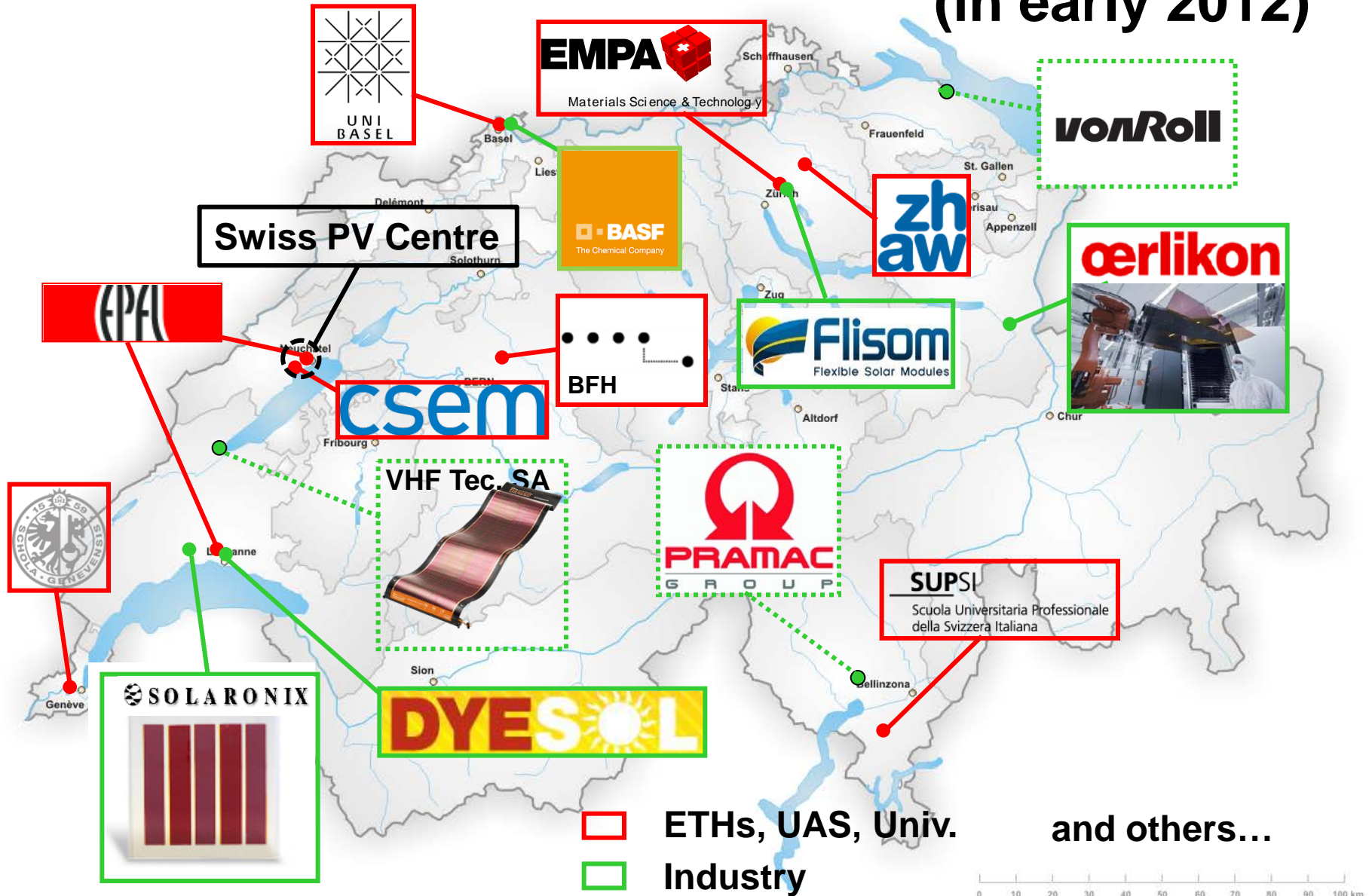
- Absorber thickness:
< 1 μm
- Large area R2R processing
- Rigid or flexible
- Ongoing R&D
- New applications, building integration and facile installation

High cost reduction potential










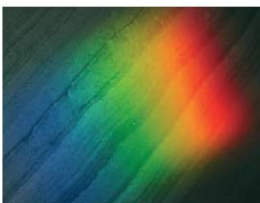


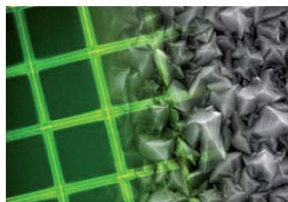
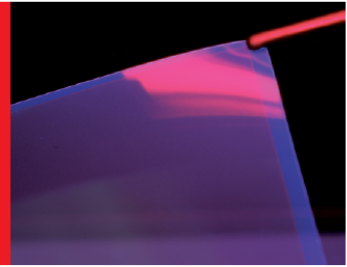
and others

Thin Film Solar Cells Research and Production (in early 2012)



ThinPV & DURSOL - federative projects funded by CCEM and swisselectric research

- Regular meetings with partners from all thin PV technologies
- Organization of Lab tours
- Make equipment available to partners
- Promote new funding opportunities (CTI, EWZ, NCCR, NRP, etc.)
- Organize workshops and conferences

 <p>EMPA AKADEMIE Zentrum für Wissenstransfer</p>	 <p>125 years of Empa</p>	 <p>EMPA AKADEMIE Zentrum für Wissenstransfer</p>	 <p>ccem.ch swisselectric research</p>	 <p>EMPA AKADEMIE Zentrum für Wissenstransfer</p>	 <p>ccem.ch swisselectric research</p>	 <p>EMPA AKADEMIE Zentrum für Wissenstransfer</p>	 <p>ccem.ch swisselectric research</p>	 <p>EMPA AKADEMIE Zentrum für Wissenstransfer</p>
<p>Conference Photovoltaics of the Future</p>  <p>Empa, CH-8600 Dübendorf AKADEMIE Überlandstrasse 129 Tuesday, April 12, 2005 9 am to 6 pm</p>	<p>Workshop Thin Film PV - Needs and Desires from Industry</p>  <p>Empa AKADEMIE Überlandstrasse 129 Dübendorf Friday 5th October 2007 9:30 am to 6:00 pm</p>	<p>Workshop A look inside solar cells</p>  <p>Monte Verità Ascona, Switzerland November, 16-18, 2008 Registration online at www.empa.ch/scw</p>	<p>Workshop Transparent Conducting Electrodes for Photovoltaics</p>  <p>Stade de Sully Bern, Switzerland Monday, January 25th, 2010 Registration online at www.empa.ch/tpv</p>	<p>WORKSHOP Durability of Thin Film Solar Cells Status and Assessment</p>  <p>Empa, Dübendorf, Überlandstrasse 129 Wednesday, April 4th 2012, 9am to 5pm Online registration www.empa.ch/dursol</p>				

Why do we need a Swiss PV research platform?

- **Crossfertilization by bringing the competences in thin PV but also crystalline PV together.**
- **Make knowhow and instruments available to the Swiss PV R&D community**
- **Promote and coordinate R&D projects within Switzerland**
- **Organize topical workshops and conferences (durability, EPBT, needs from industry, testing and standardization, economics, LCA etc.)**

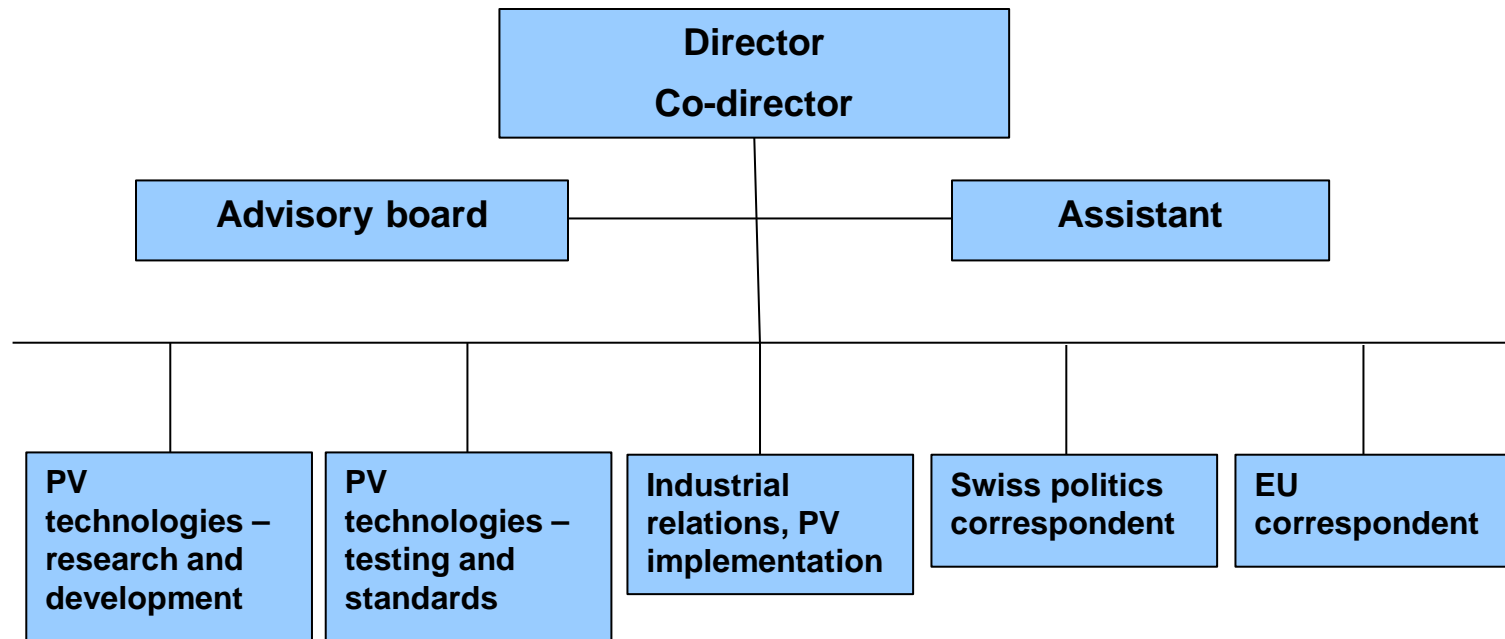
Financing structure?

- **Seed money from Swissphotonics network for:**
 - **workshop activities**
 - **small focused and interdisciplinary projects**
 - **Shared equipment (certified testing, permeability measurement of encapsulation etc.)**
- **Other network projects (e.g. EU)**
- **Own contribution from partners**
- **Sponsoring**

Output?

- **Workshop organization**
- **Support (e.g. partner search, initiatives, information about initiatives,...) for R&D project proposition**
- **Network maintainance and development**
- **Mediation and coordination within network**
- **Information on educational activities, courses for R&D**

How would the platform be structured?



Director, co-director: responsible for all operations, e.g. organization of workshops

Advisory board: Coordination with other PV activities and centres in Switzerland

Correspondents: Report on the various PV activities and cultivate contacts to academic and industrial partners

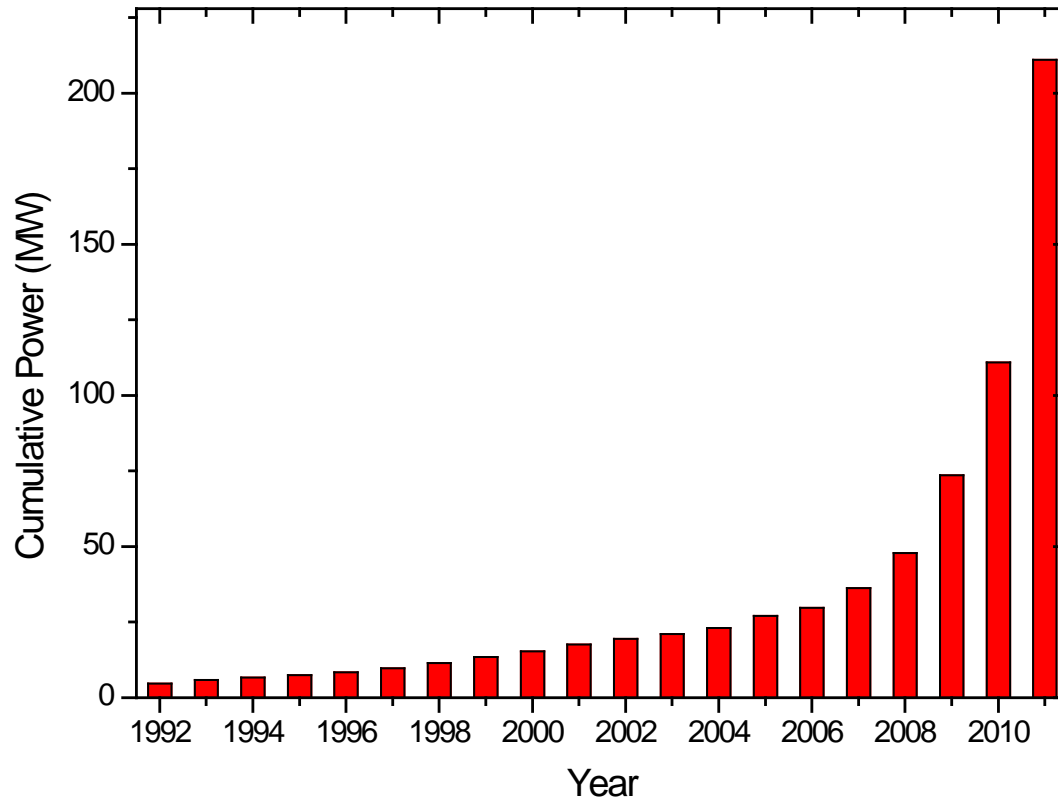
Reporting?

- **Yearly report (activity and finances) to the Swissphotonics Network**
- **Dissemination in other national sources (e.g. PV BFE report)**
- **Specific publications in journals, bulletins, public media**

Further Suggestions?



PV is growing - also in Switzerland



Trends in photovoltaic applications,
Report IEA-PVPS T1-21:2012

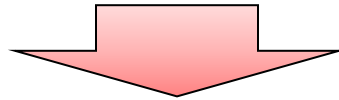


Swiss Energy Strategy 2050: 2000 – 6000 MW

Large area PV processing and Thin Film technologies can reduce the production cost

High throughput processing leads to low depreciation and low cost

- R2R processing of substrates
- R2R processing of photonic stacks
- R2R processing of stack encapsulation



Thin Film technologies cut costs for active materials by a factor of about 100 (as compared to crystalline silicon technology)

For organic photovoltaics consumption of active materials is even lower:

1g for 10 m² or 1t for 1 TWh/year (Switzerland, 8% efficiency)