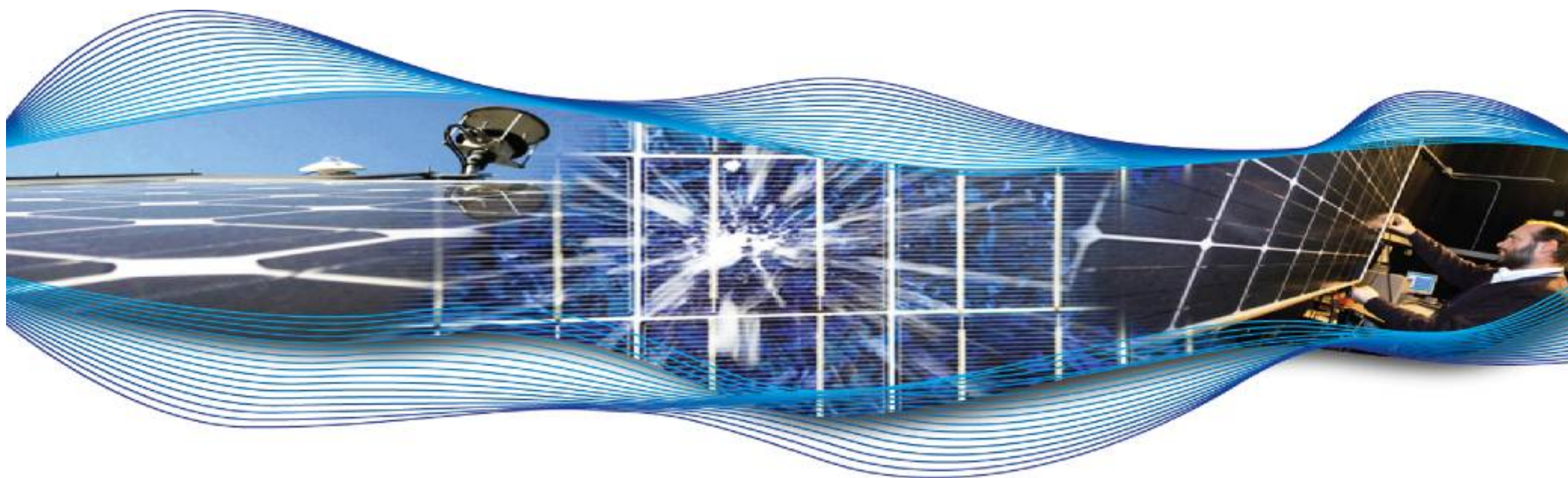


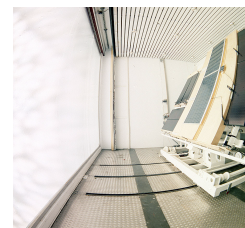
# Photovoltaic Solar Electricity

## Renewable Energy Unit Institute for Energy

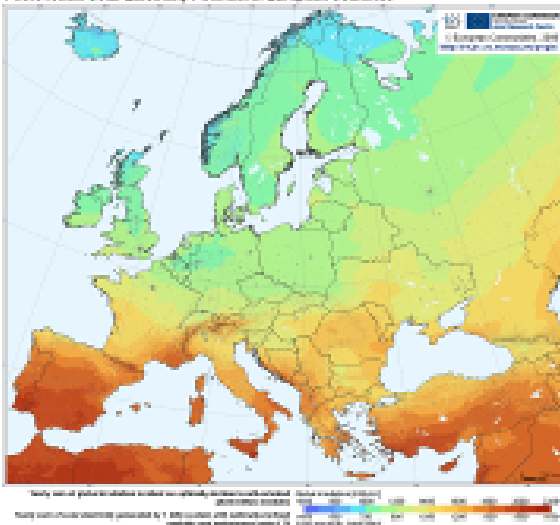


- *Do next generation photovoltaic technologies also have 30 years lifetime? Or more? ... and how do they end their life? ... after how much electricity produced?*
- *Does the buyer really get what he pays for? (performance verification)*
- *Where is PV best located? Does it pay to track the sun's movement and to concentrate power?*
- *Can we push the technology to its efficiency limits? (>60%)*
- *What kind of large-scale distribution do we need?*

- European reference lab for PV performance
- ISO 17025 accreditation, with full traceability to SI units and best-in-class uncertainty levels



Photovoltaic Solar Electricity Potential in European Countries



## Facilities:

- 6 indoor solar simulators for performance evaluation of cells and modules
- 2 climatic chambers for lifetime testing
- Large outdoor test field, including tracking systems, building-integrated PV and meteo tower
- PV-GIS solar resource analysis tool

## Commission

### JRC

#### Annual Work Prog.

- R&D
- Testing and/or R&D performed under MoUs or Collaboration Agreements

Shared Cost R&D Projects (DG-RTD)

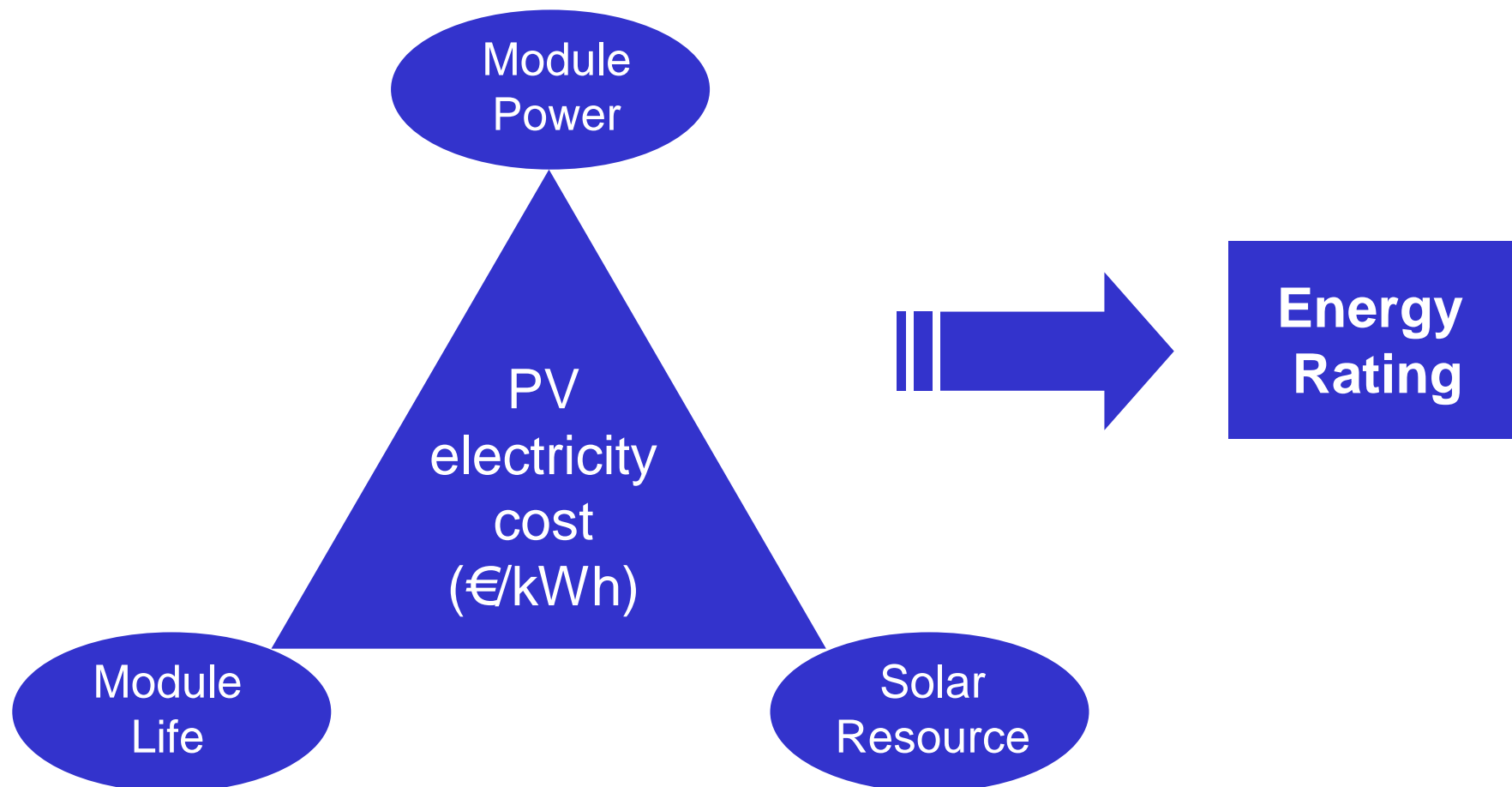
### Other DGs

“Administrative arrangements” with policy DGs

## External

Testing services  
(ESTI price list)

R&D contracts  
with third parties





Market value of  $\pm 1\%$   
uncertainty:

2007:  $\pm 240$  Mio€

2010:  $\pm 1050$  Mio€

*\*) assuming worldwide production/capacity  
figures and an average price of 3€/Wp*



**Consumers and industry rely on accurate  
performance measurement**

- § calibration of reference devices under ISO 17025 accreditation
- § 2 major European intercomparisons
- § 2 new industrial collaborations
- § new capabilities for (tandem thin film modules and cells for concentrator PV systems)

2009- Calibration of reference devices		
Scope	No.	Client
MoUs, supporting traceability in the EU	45	AIT, CENER, ECN, ENEA, FhG-ISE
Commercial	44	BP Solar, Mitsubishi, Oerlikon, Tenesol, Wuerth Solar,
ESTI reference cells	27	Internal annual calibration

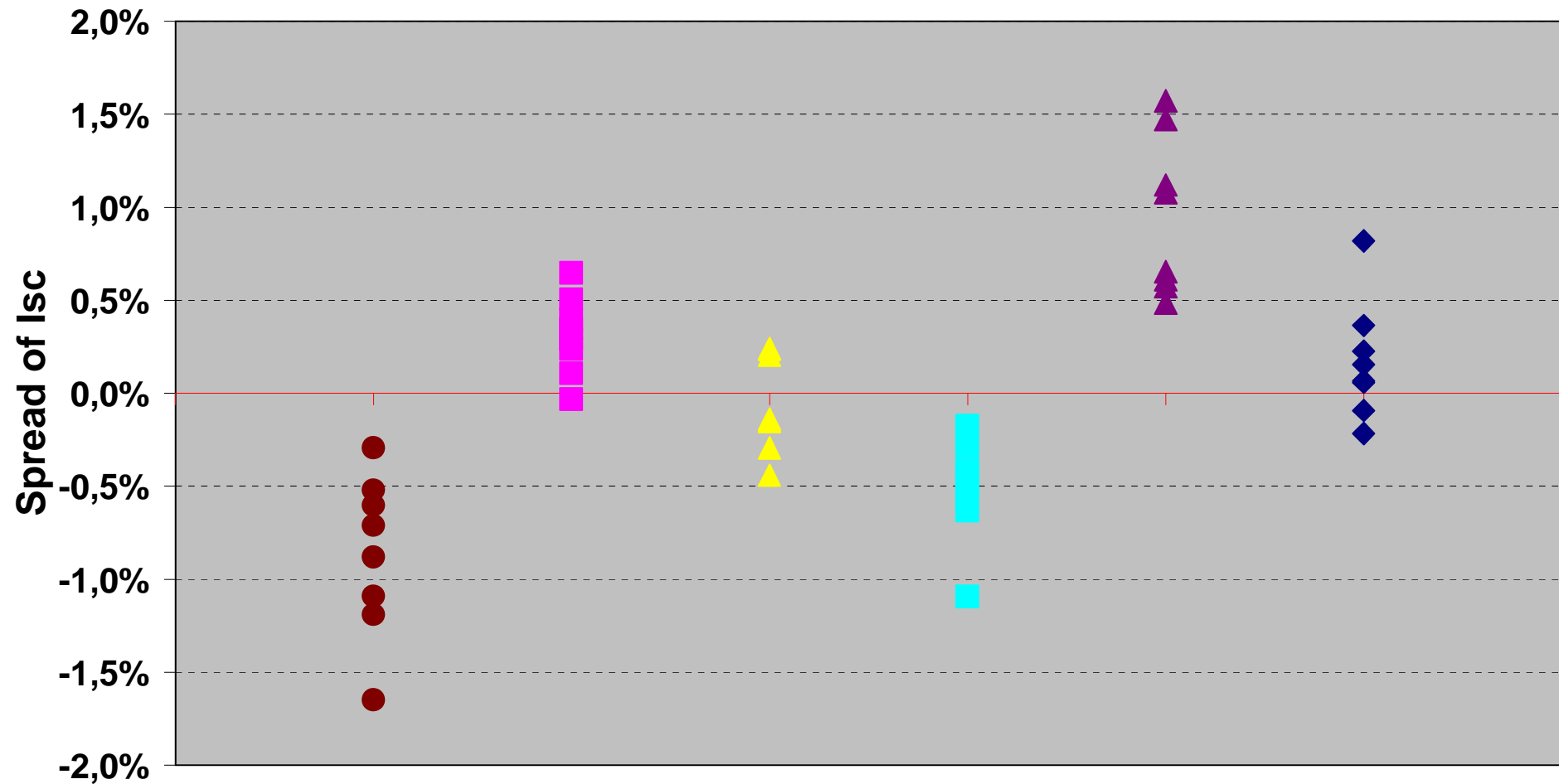


### ***Recent Highlights:***

- ***Nov. 2009: calibration of the new world record crystalline silicon PV module with 17% efficiency from ECN/REC***
- ***Feb. 2010: first calibration certificate for tandem a/ $\mu$ aSi module, including spectral response correction***

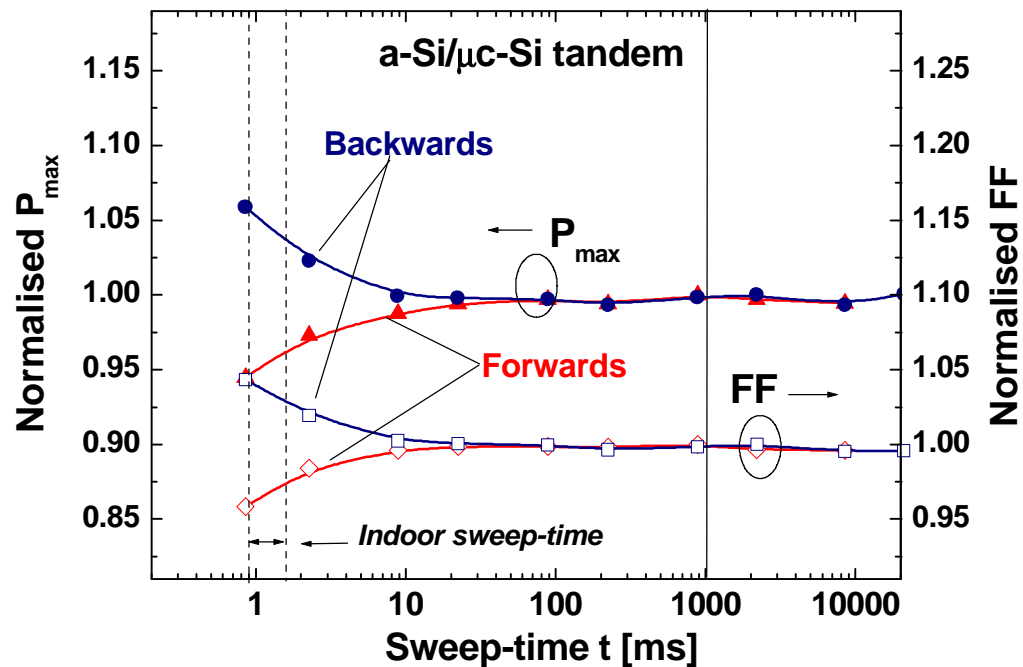
### Spread of reported Isc values @ STC

## Deviation from module averages



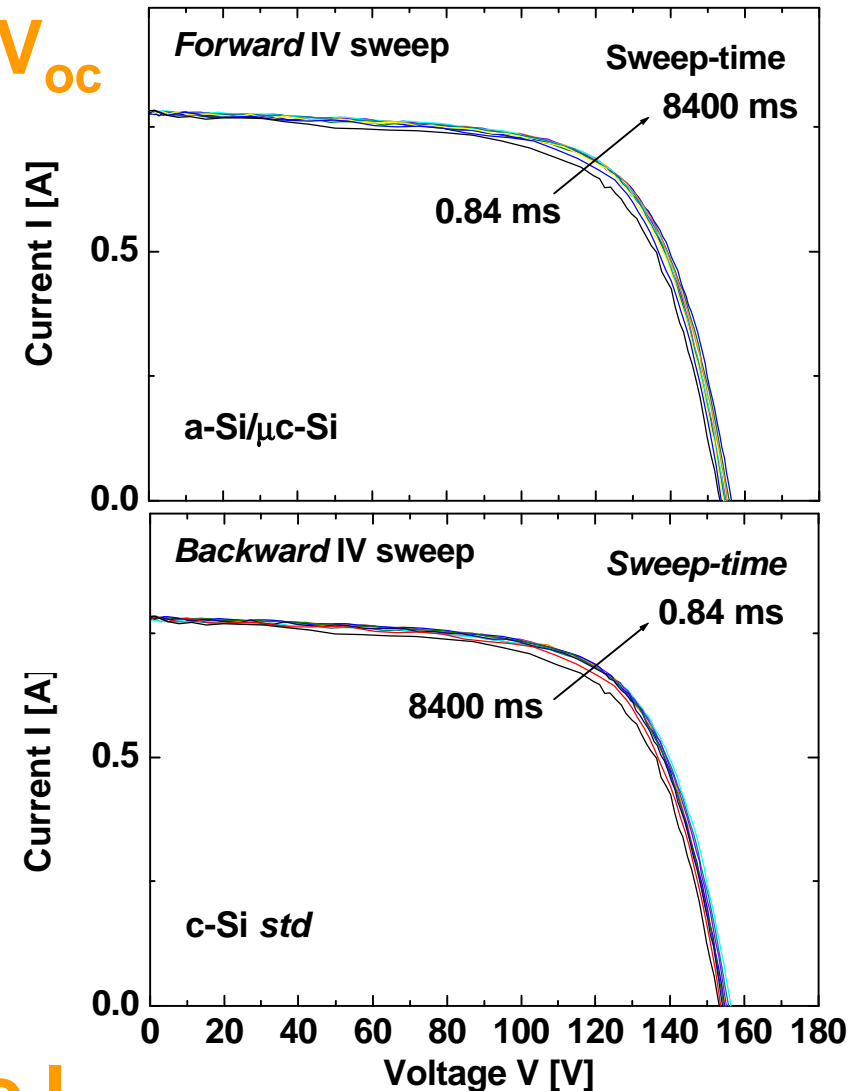


## a-Si/ $\mu$ c-Si



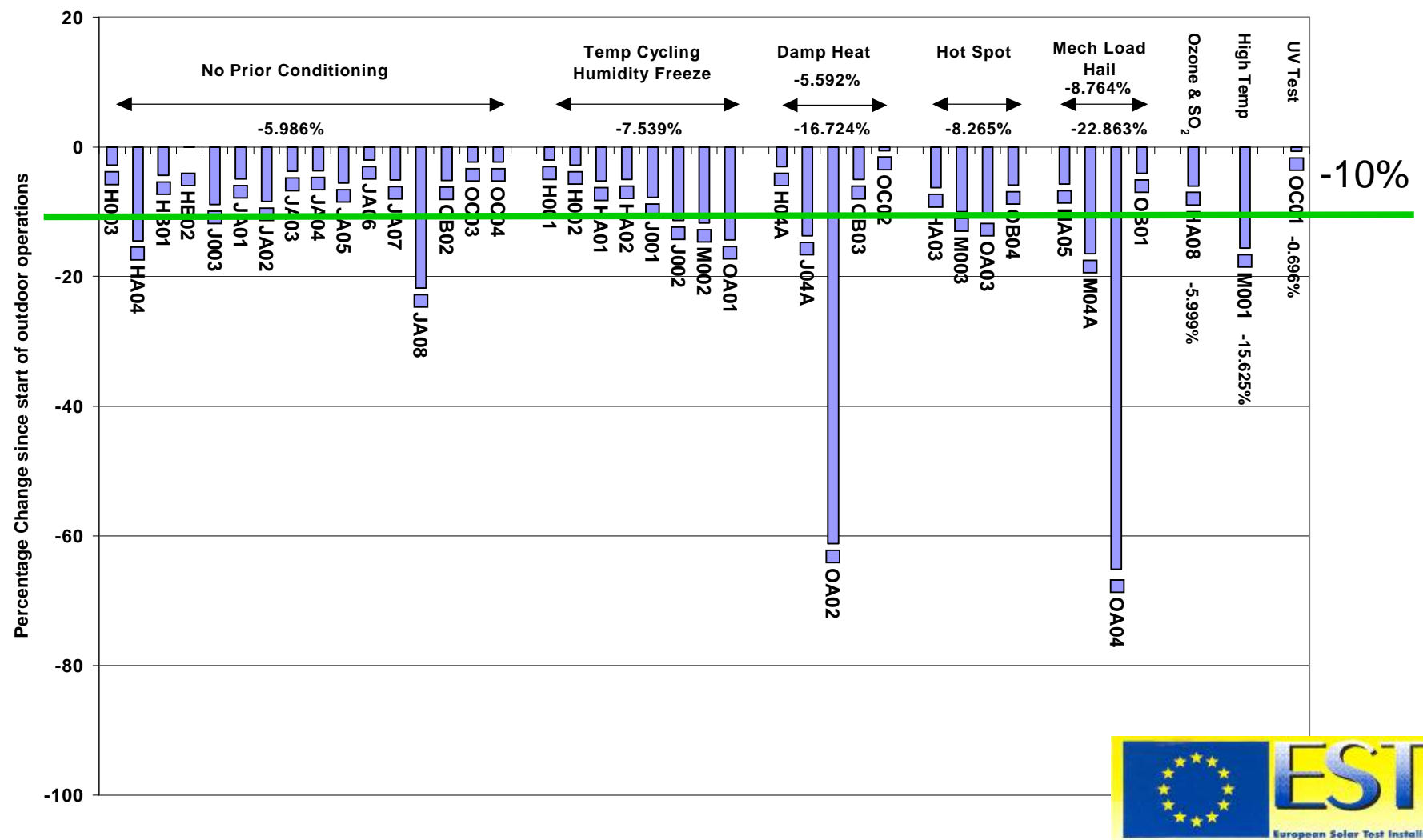
a-Si and micromorph large-area modules are susceptible to *sweep-time* effects below 10 ms.

$I_{sc}$  to  $V_{oc}$



$V_{oc}$  to  $I_{sc}$

after 22 yrs of operation: lifetime probably >30 years

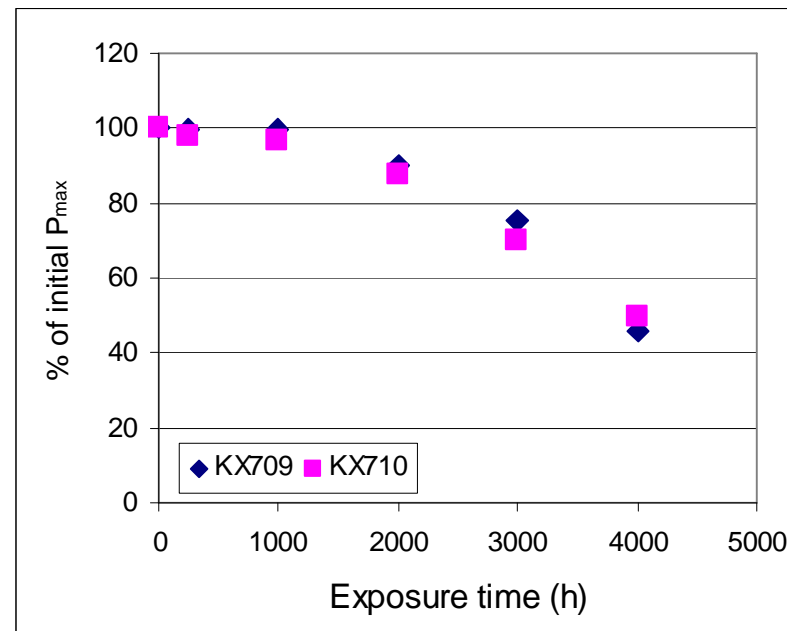


- Sequential damp heat exposure tests used to induce accelerated aging on thin-film modules.
- However not possible to equate loss of power to a number of years of outdoor exposure

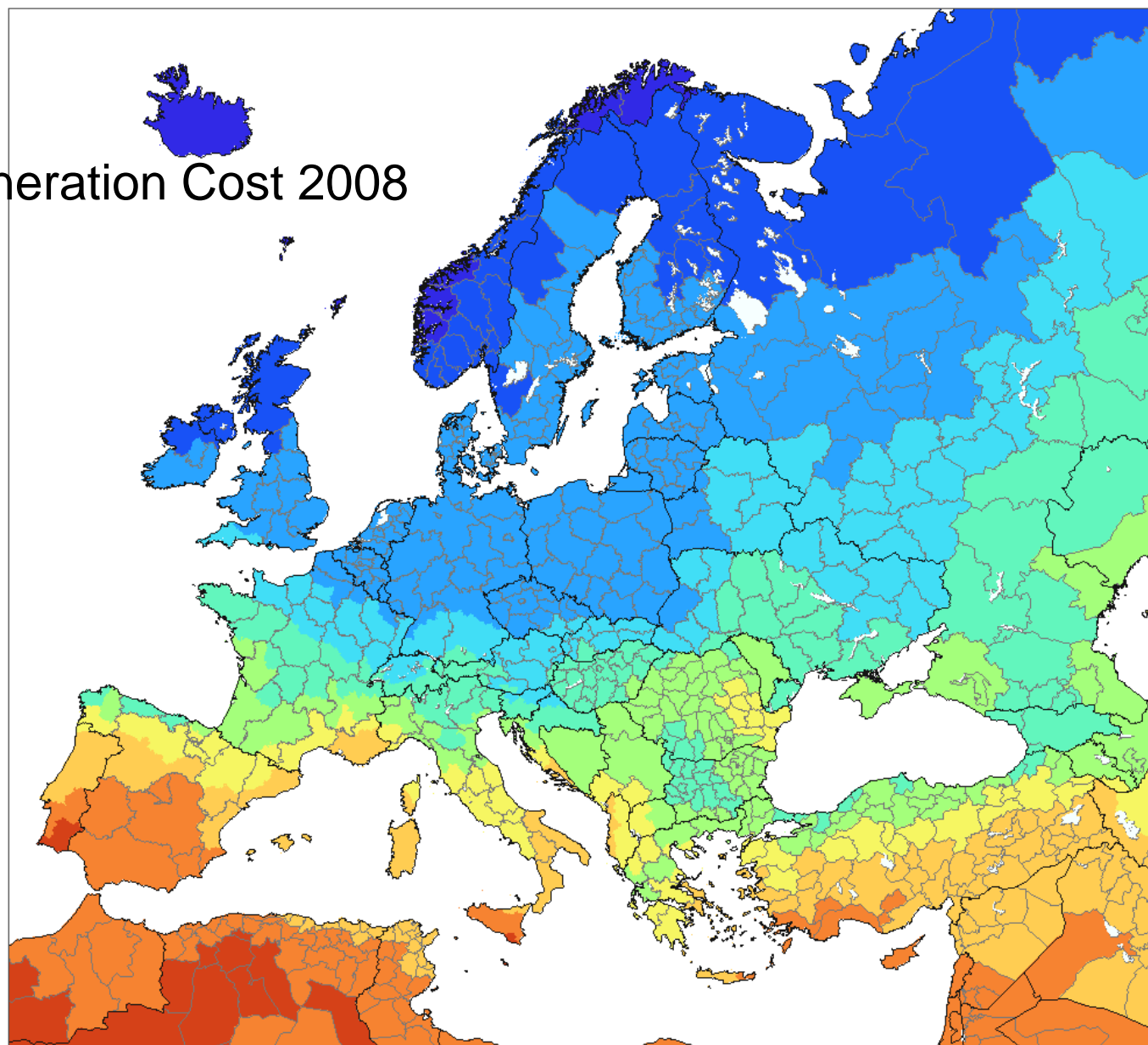
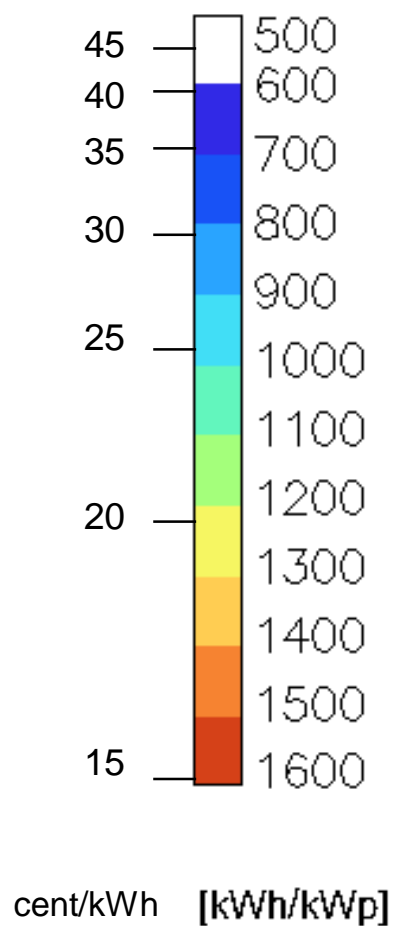
ESTI Code	Damp Heat (h)	Percentage of the initial value			
		V <sub>oc</sub>	FF	P <sub>max</sub>	I <sub>sc</sub>
KX709	0	100	100	100	100
	250	100.7	98.5	99.4	100.2
	1000	100.3	98.8	99.4	100.2
	2000	98	91.5	90.1	100.5
	3000	96.9	78.9	75.3	98.5
	4000	95.1	50.1	45.6	95.6
KX710	0	100	100	100	100
	250	100.1	97.9	98	100
	1000	99.4	97.5	96.8	99.9
	2000	98.1	89.5	87.8	100
	3000	96.9	73.9	70	97.8
	4000	94.9	59.4	49.8	88.4

## Relative light-soaked stabilized values for the CdTe modules

### P<sub>max</sub> vs Time



## Regional PV-Generation Cost 2008



1 MW System Cost: 4 €/kWp, Interest: 2% above Inflation, optimum tilt angle, 20 yrs lifetime, PR 0.75

## World-Leading PV Conference

### JRC chairs the conference scientific committee



  
Joint

**25th European Photovoltaic Solar Energy  
Conference and Exhibition 2010**  
and  
**5th World Conference  
on Photovoltaic Energy Conversion**

Conference Chairman: Giovanni Federigo De Santì,  
Director, Institute for Energy, Joint Research Centre, European Commission

Feria Valencia, Spain  
Conference 06 - 10 September • Exhibition 06 - 09 September  
[www.photovoltaic-conference.com](http://www.photovoltaic-conference.com)

In conference partnership with:

 36th  
US IEEE Photovoltaic  
Specialists Conference

 20th  
Asia/Pacific PV Science and  
Engineering Conference

## European Industrial Initiatives

## European Energy Research Alliance



**Wind**



**Solar**



**Bioenergy**



**CCS**



**Electricity Grid**



**Fission**







**Objective: support** European energy technology policy,  
**providing regular, up-to-date and sound knowledge on**  
**energy technologies** - a tool for decision making by the SET-  
PLAN Steering Group

SETIS is led by the Commission's JRC

Public web site: <http://setis.ec.europa.eu/>

# Thank you!

