

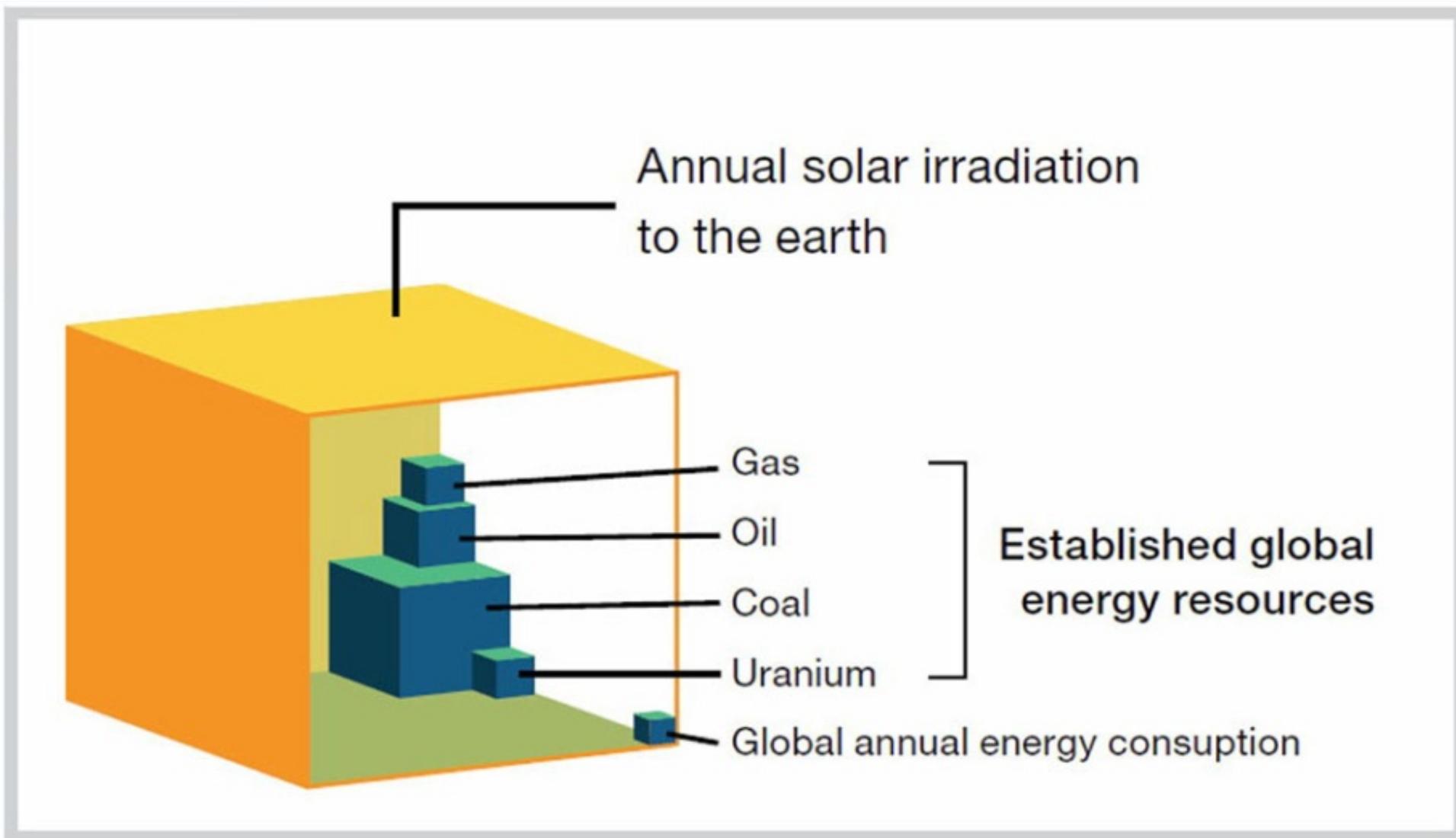


# Global Status of Photovoltaic Solar Energy

**Dr. Arnulf Jäger-Waldau**

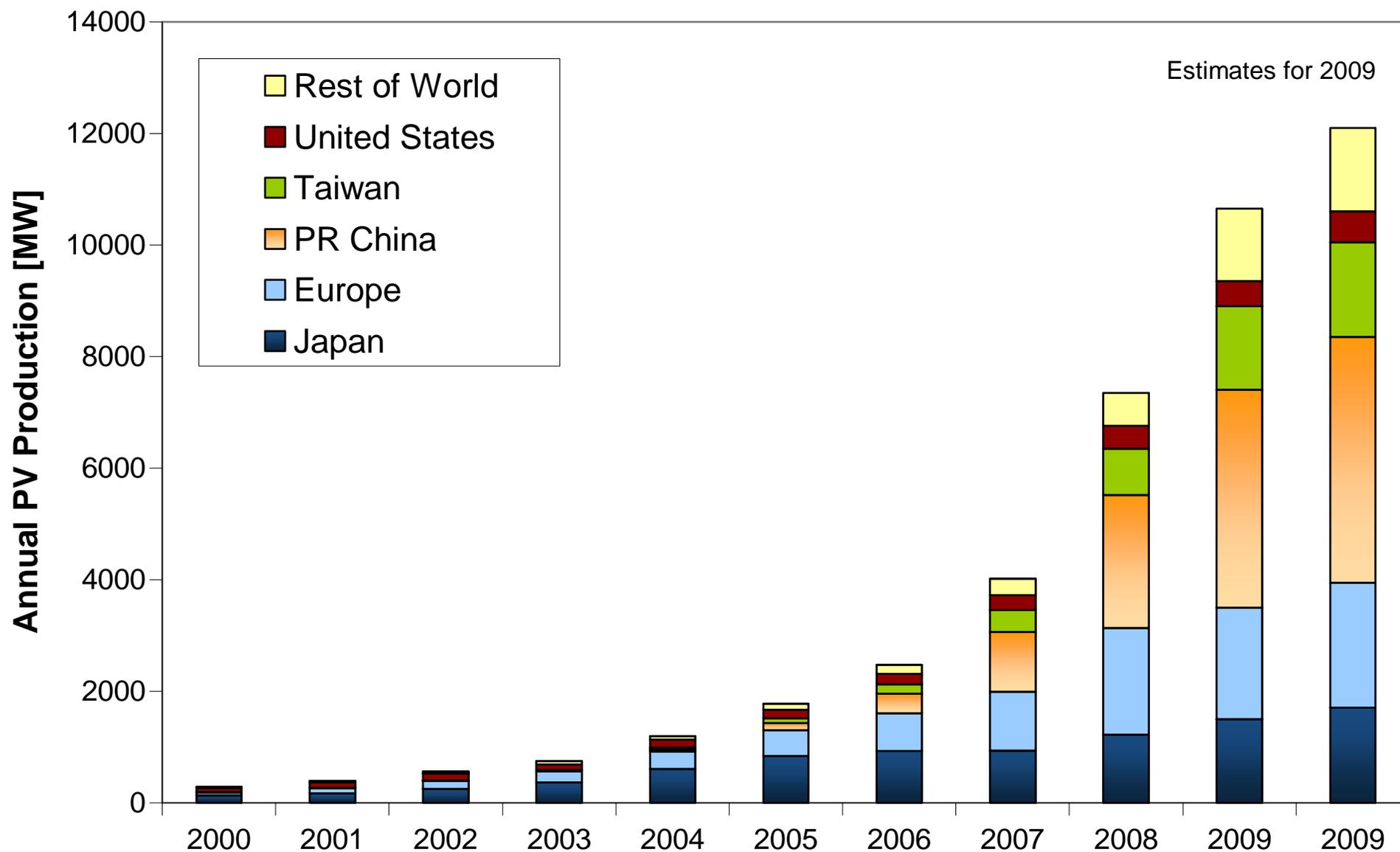
**European Commission, DG JRC, Ispra  
Institute for Energy  
Renewable Energy Unit**

- **The capacity numbers were collected from Press Announcements of over 200 different companies with a cut-off date End of February 2010.**
- **The capacity figures have a high uncertainty due to the different methods of determining them. Nevertheless they are used to show what is discussed in the public.**
- **The 2009 production estimates are derived from various market reports with a cut-off date end of March 2010.**
- **The use of the material is permitted as long as the sources are acknowledged.**
- **Neither the European Commission nor any person acting on behalf of the Commission is responsible for the use, which might be made of the following information.**

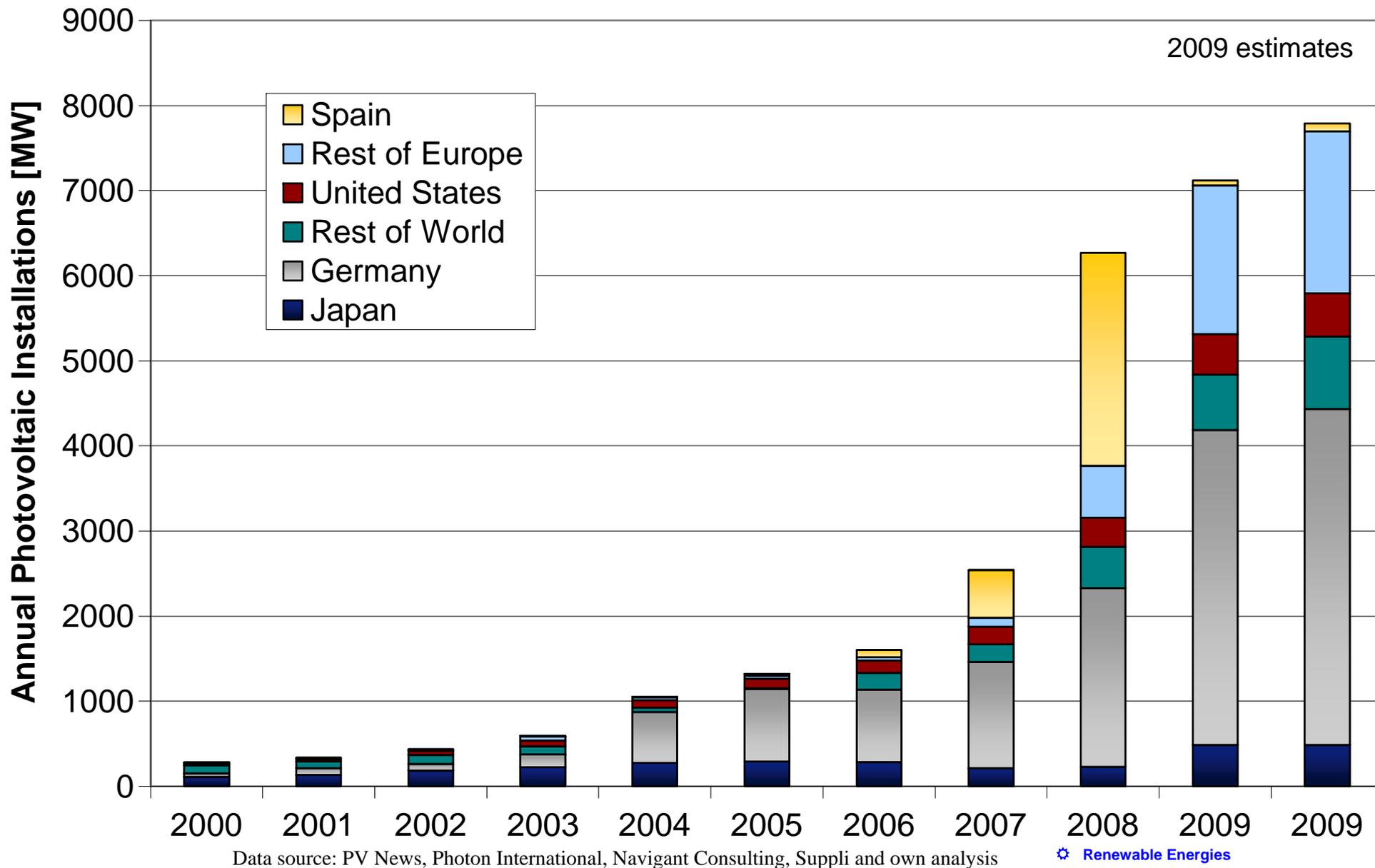


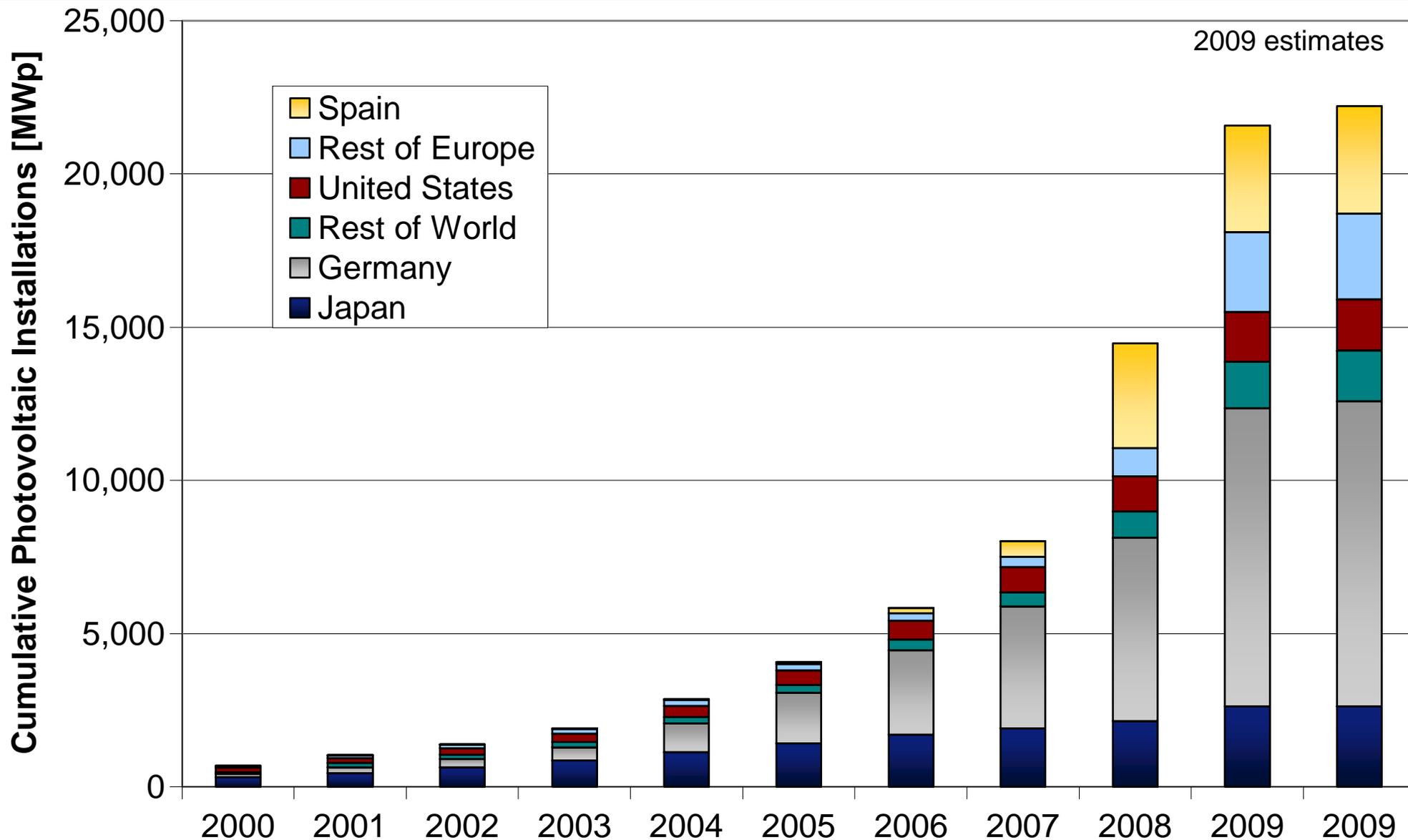
Source: Eco Solar Equipment Ltd.

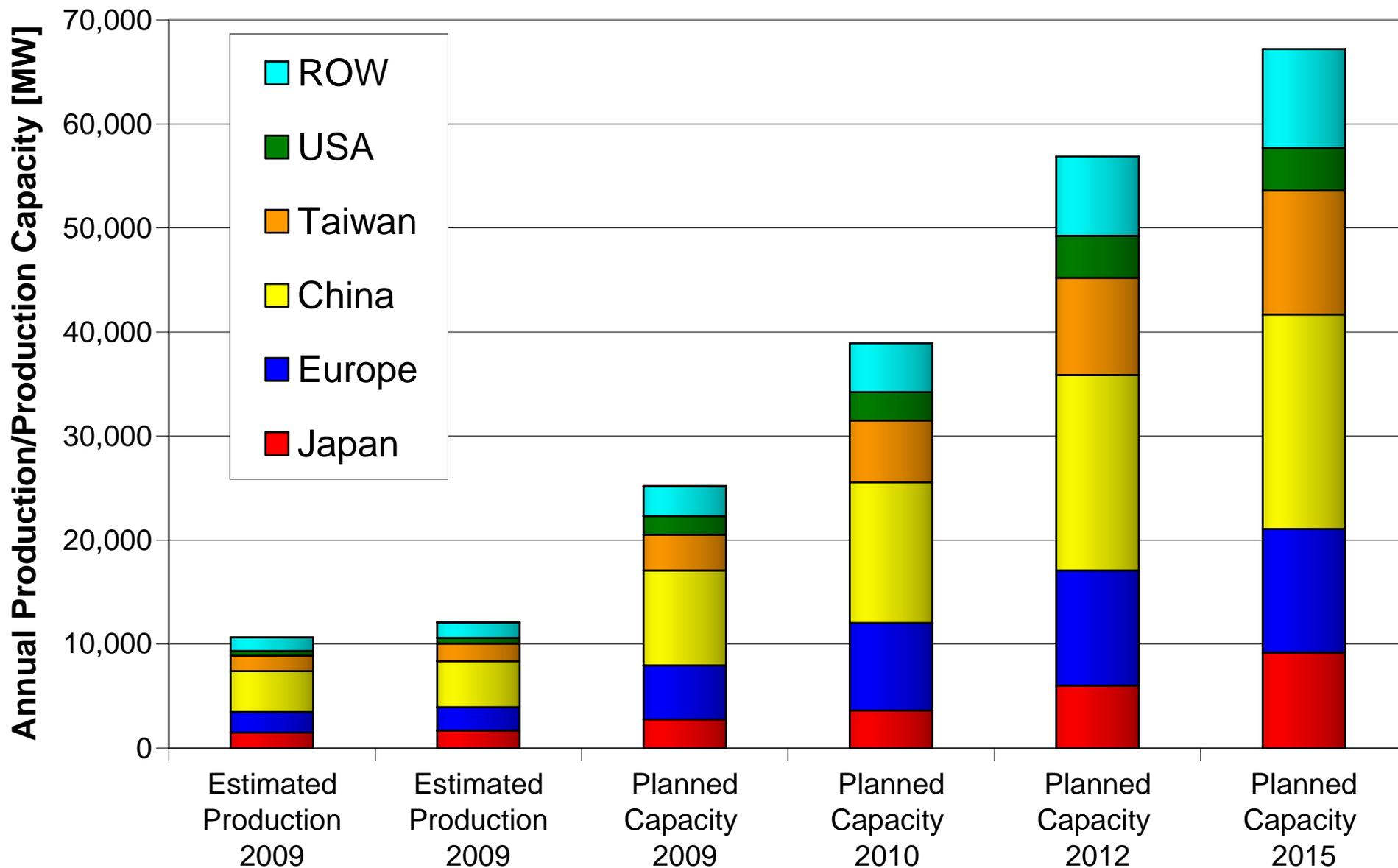
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- **Current Status**
  - **Near Future - 2020**
  - **Outlook to 2050**
  - **Conclusions**

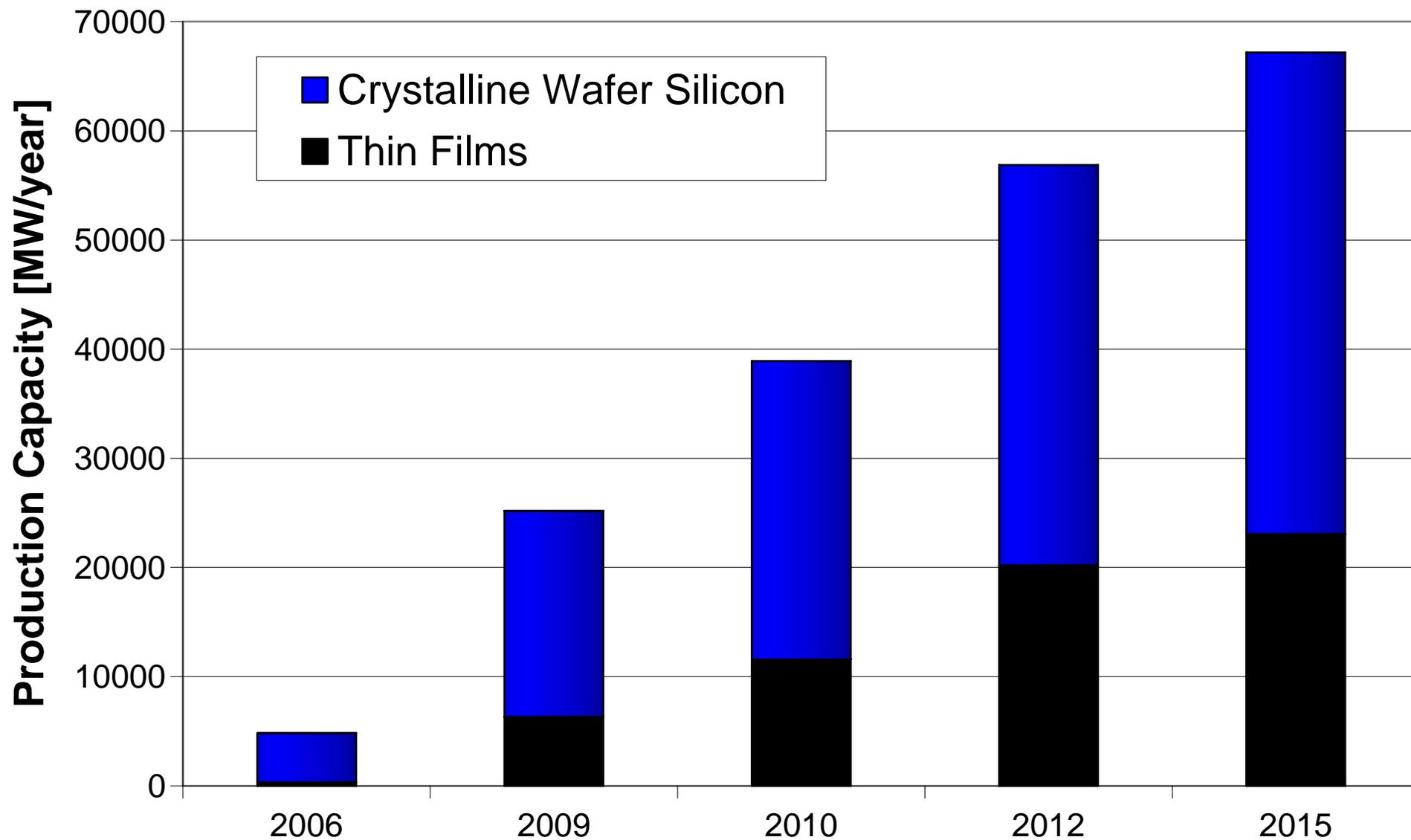


Data source: PV News, Photon International, Navigant Consulting, Suppli and own analysis

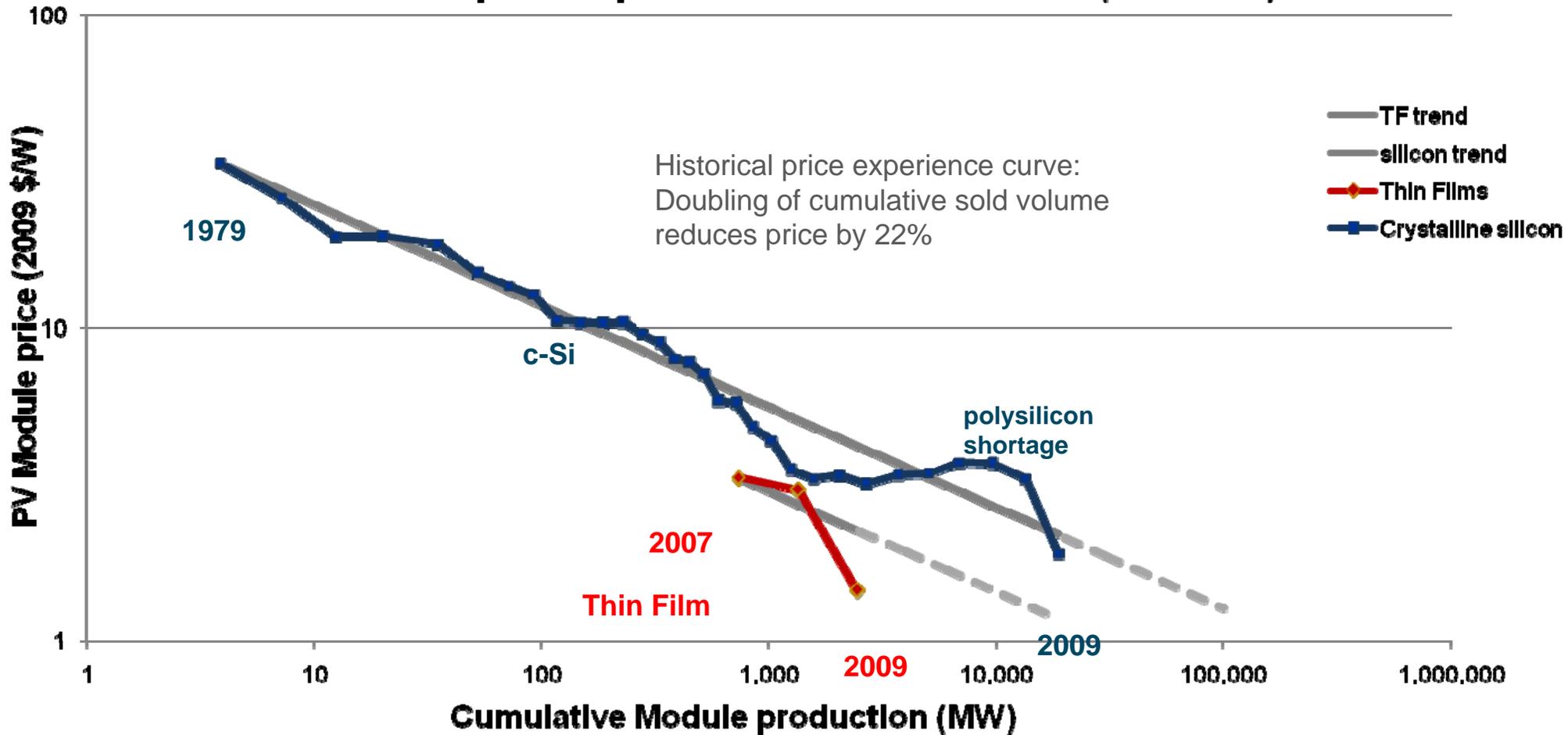






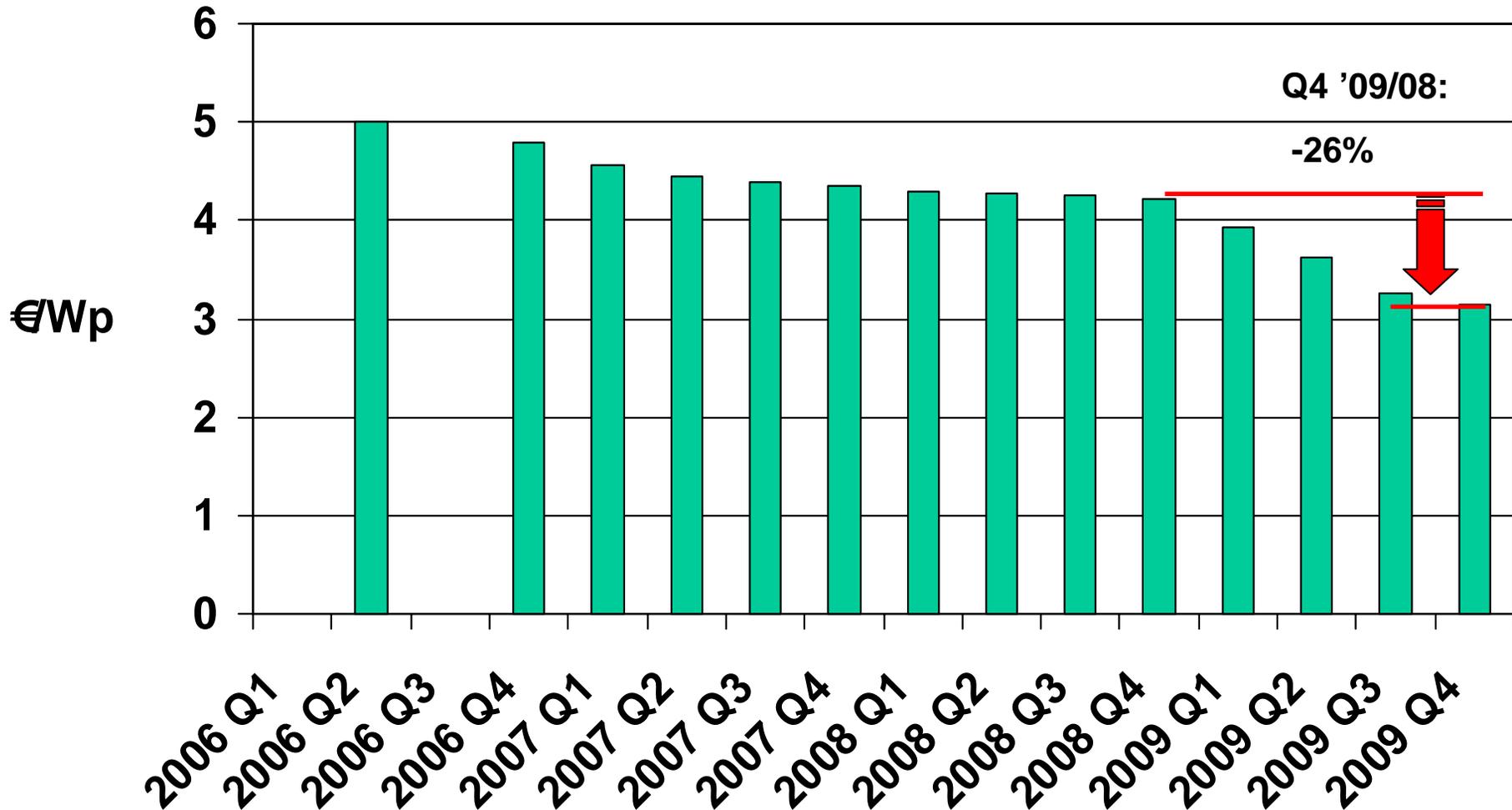


## PV Module price experience Curve since 1979 (2009 \$/W)



Source: SET for 2020, EPIA 2009

SOLAR EUROPE INDUSTRY INITIATIVE  
Setting The Pace Of The Solar Age



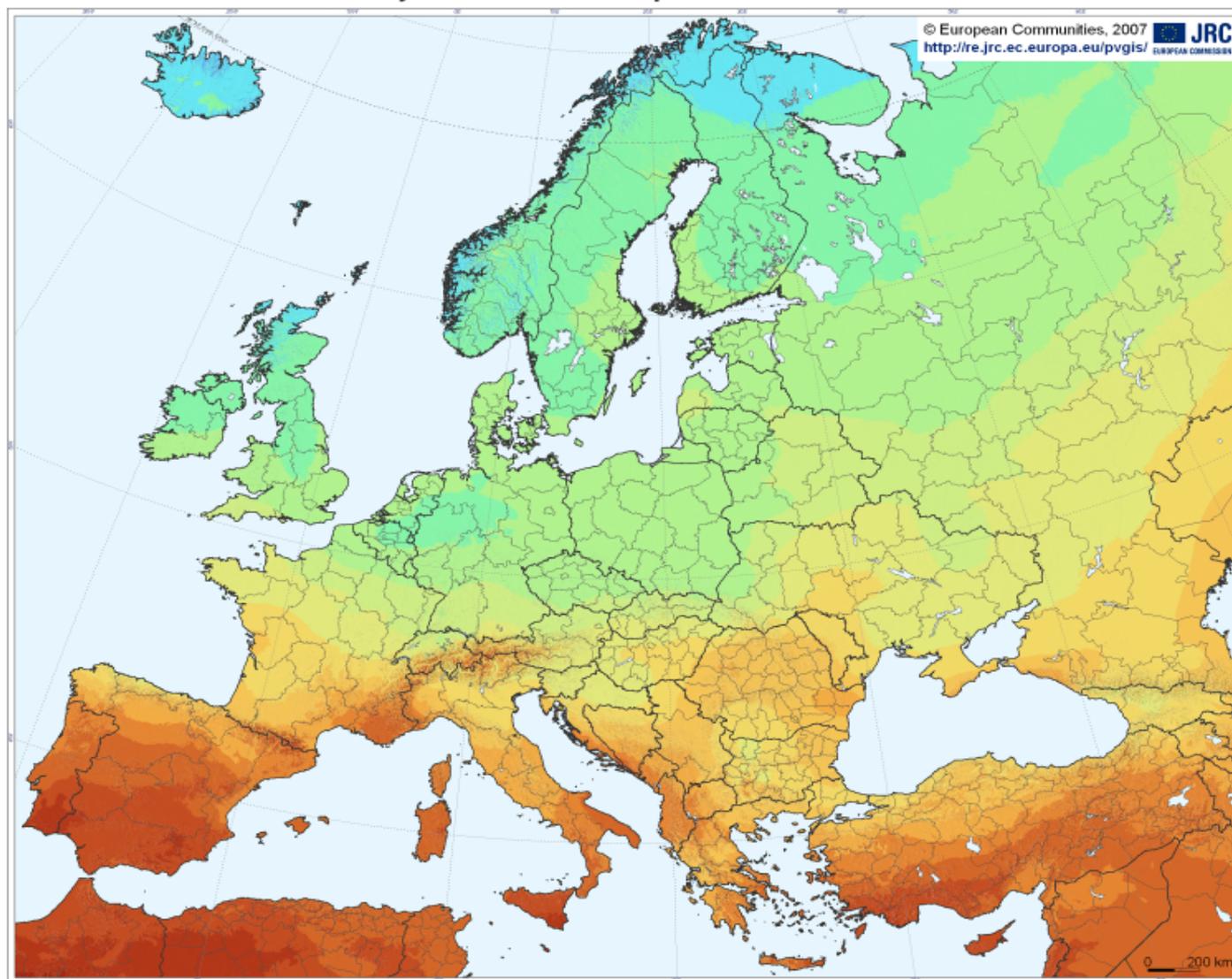
Source BSW Solar, based on EuPD-Research

**3.25 €/Wp, 30 years**

interest 5%

optimum angle

rp=0.75



Source:  
EC Joint Research Centre, PVGIS

\*Assumptions: PV system cost 3.25 €/W<sub>peak</sub>, lifetime 30 years, interest 5%, optimally tilted modules, performance ratio 0.75

- **2008 European sector turnover, without electricity sales** > 15 billion €
- **2008 R & D investments in Europe** > 400 million €
- **2008 PV jobs in Europe** > 100,000
- **2009 PV jobs in Europe** ~ 80,000 – 85,000
- **2003-2008 CAGR of EU annual market:** 89%
- **2008 cumulative installed PV capacity**
  - World ~ 15 GW
  - Europe ~ 9.7 GW
- **2008 CO<sub>2</sub> avoidance in Europe** ~ 5 million t

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- **Current Status**
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## Political Framework

- January 2006: RE-Promotion Law
- September 2007: Mid and long-Term Development Plan (NDRC)
  - Unofficial targets released in Mid May 2009  
2 GW by 2011 and 20 GW by 2020
- May 2009: Long-Term Solar Development Plan (State Council)  
Proposed targets: 3.5 GW - 2010, 50GW - 2020, 500 GW - 2050

## Planned PV projects

- The Solar Roofs Plan: focus on supporting BIPV projects  
90 MW will be partly sponsored, 13-17 Yuan/Watt (March 2009)
- The Golden Sun Project: approx 300 demonstration projects  
budget: approx. 20 billion Yuan for 3 years, 640 MW (July 2009)
- Solar power station projects: approx. 12 GW by 2013

## Political Framework

- July 2008: National Action Plan on Climate Change
- November 2009 : National Solar Mission  
20 GW by 2020, 100 GW by 2030 and 200 GW by 2050

## Planned PV projects

- Eleventh Five Year Plan (2008 – 2012) target:  
support from Ministry of Non-Conventional Energy Sources for  
50 MW grid-connected
- NSM targets for off grid electricity:  
200 MW by 2013, 1000 MW by 2017 and 2000MW by 2022
- Various solar power station projects: few 100 MW

## Political Framework

- July 2008: Action Plan for Achieving a Low-carbon Society
- November 2008: Action Plan for Promoting the Introduction of Solar Power Generation
- July 2009: *Surplus Power Purchase Programme*
- A new feed-in system is currently under discussion

## Planned PV projects

- Federation of Electric Power Companies of Japan (FEPC):  
10 GW by 2020

## Political Framework

- August 2006: Californian “Million Solar Roofs Plan” - Senate Bill 1
- October 2008: *Energy Improvement and Extension Act of 2008*
- February 2009: *American Recovery and Reinvestment Act (ARRA)*
- Renewable Portfolio Standards in 29 States + DC

## Planned PV projects

- California (at the end 2009)
  - ARRA Funds: 18 project applications with 2.6 GW capacity
  - Non ARRA: 64 project applications with 19.2 GW capacity
- Bureau of Land Management (BLM) has fast tracked 4 projects with about 1 GW (2 CA, 2 NV)

## **Korea: Third National Renewable Energy Plan**

Aim: Renewable Energies share of  
4.3% in 2015, 6.1% in 2020 and 11% in 2030  
PV target: 1.3 GW by 2012 and 4 GW by 2020

## **Taiwan: Solar Energy Development Project**

Aim: 7.5 million residents should utilise solar energy  
by 2030; 1.2 GW PV by 2020

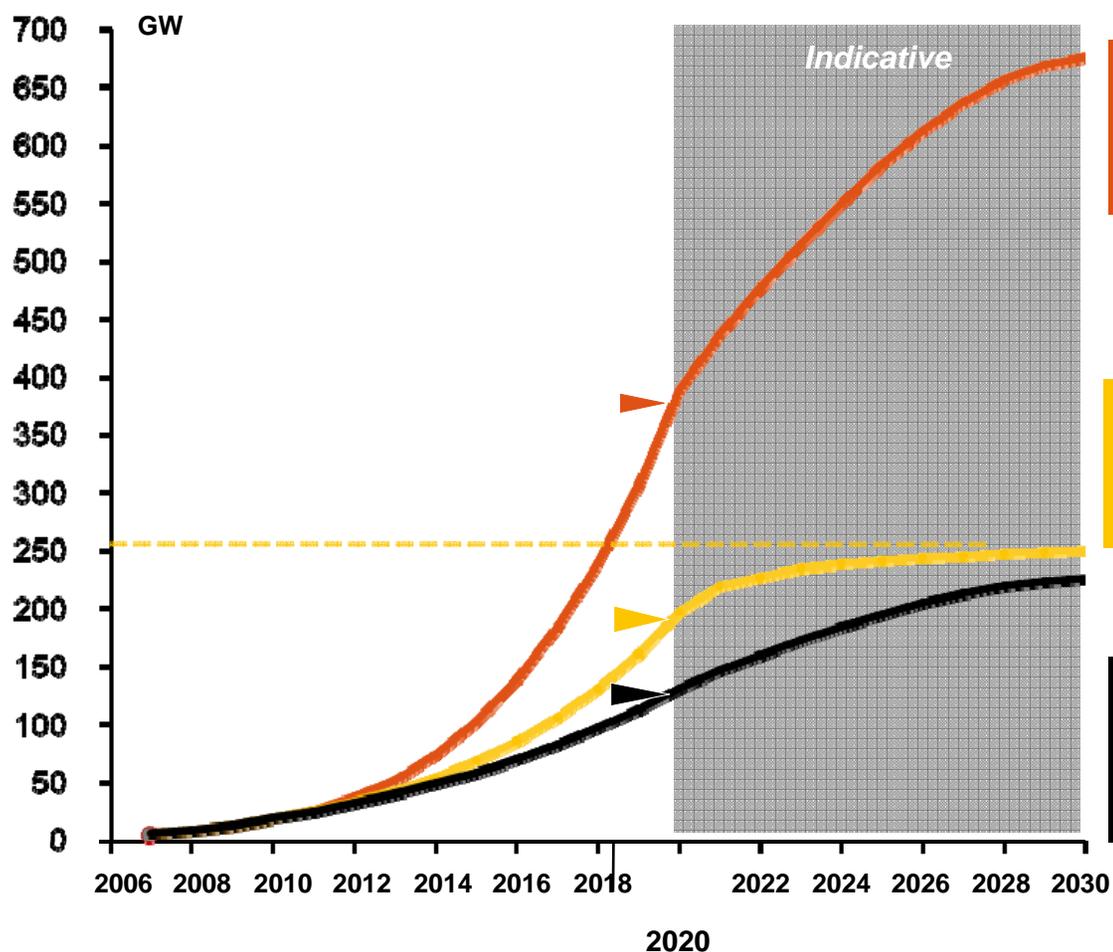
## **Thailand: Renewable Energy Development Plan**

12.6% of peak electricity capacity from Renewables  
PV Target 500 MW by 2022

## **Malaysia: Feed-in tariff for Renewable and PV proposed**

## **Vietnam: Possible Renewable Energy Law under discussion**

## Share of Electricity-Demand by 2020



**Paradigm Shift Scenario: 12%**

**Accelerated Scenario: 6%**

**Baseline Scenario: 4%**

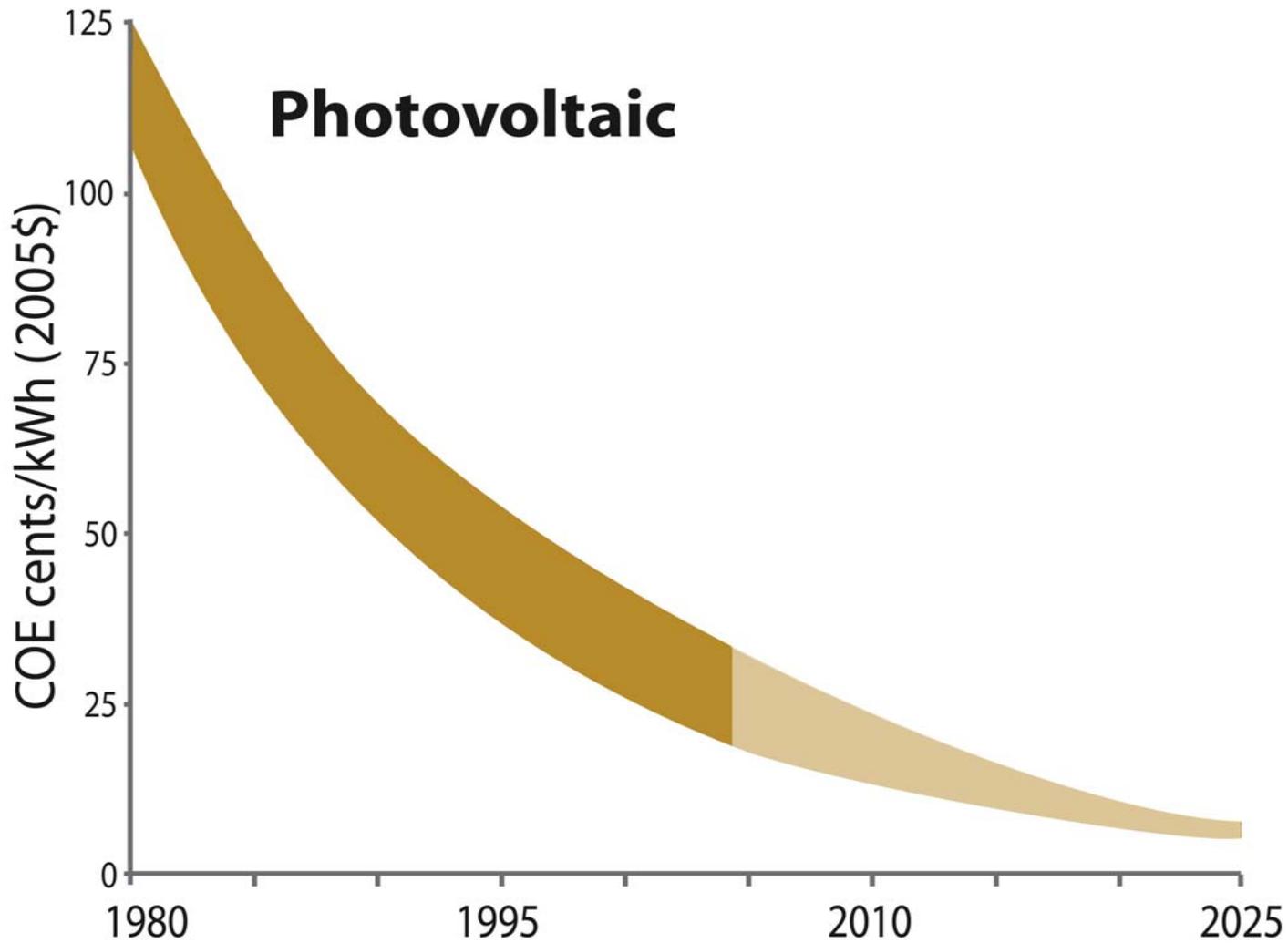
Source: Set For 2020, EPIA 2009

## How realistic is a 12% share of PV electricity?

- 462 TWh, 390 GW cumulative installed
- CAGR of 35% for 12 years needed
- 2013 milestone 30 GW world, 17.5 Europe
- Huge markets and R&D have started outside Europe (US, China, India)
- Keep EU leadership
- More than 35% annual growth have been demonstrated
- 100 GW annual installation in 2020

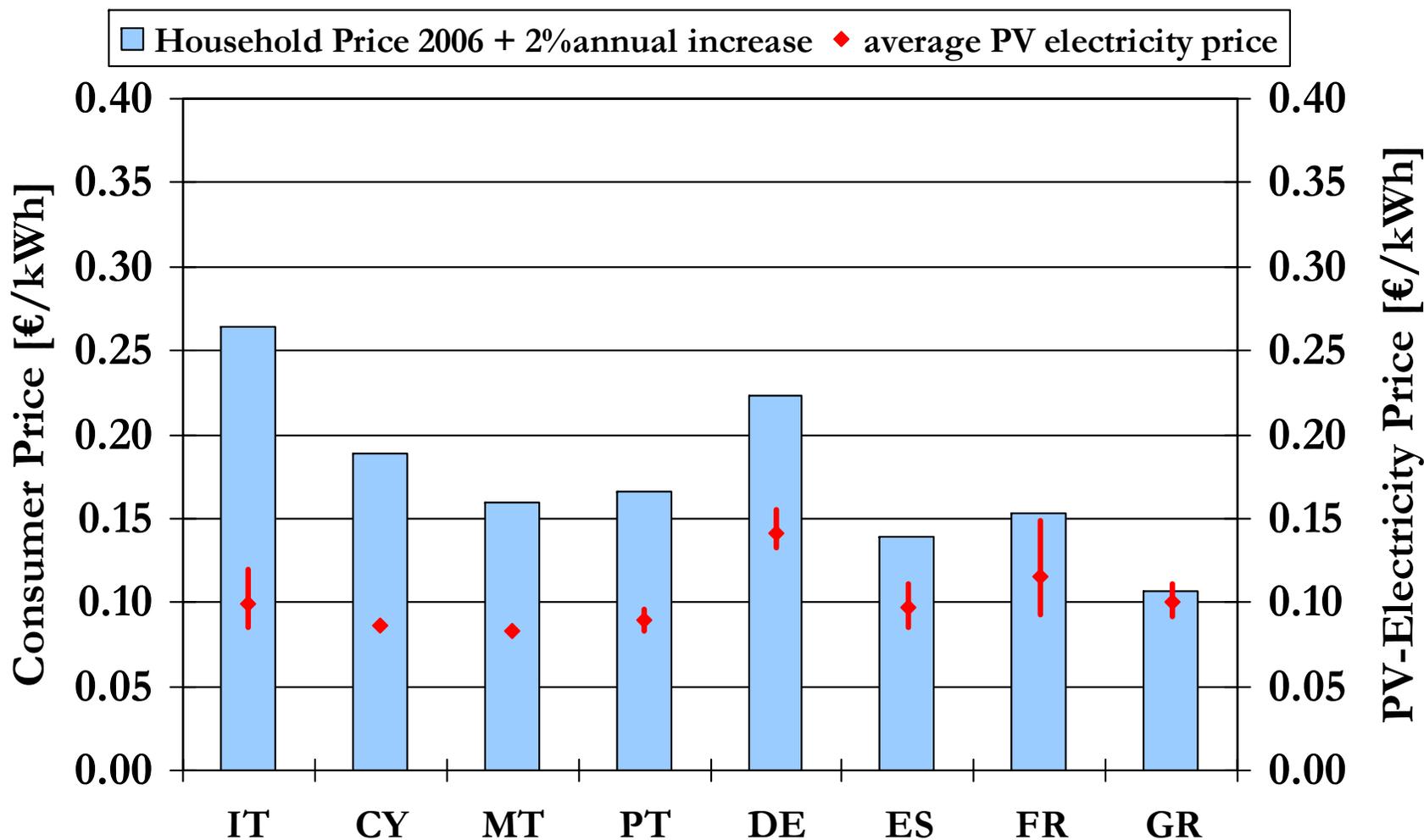
### Required:

- Feed-in Tariffs (fine tuned!)
- Grid Management
- World-wide Emission Trading



Source: NREL Energy Analysis Office ([www.nrel.gov/analysis/docs/cost\\_curves\\_2005.ppt](http://www.nrel.gov/analysis/docs/cost_curves_2005.ppt))

<sup>1</sup>These graphs are reflections of historical cost trends NOT precise annual historical data. DRAFT November 2005



Assumptions: **2€/kWp**; 4% Interest; 0.5%/yr O&M; **30 yr** operational life

Source: EC Joint Research Centre, PVGIS

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## Carbon Neutral Community



Hydrogen Fuels Production

Pedestrian Walkways

Renewable Fuels

Public Transportation

High-Efficiency Buildings

Bioenergy Production

Hybrids Cars

Geothermal Powered Industrial Heating

Biomass Fuels Production

National Renewable Energy Laboratory  
Innovation for Our Energy Future

- **After 2020 the European Market for newly installed PV systems will represent less than the 50% anticipated until then**
- **Large markets will be China, Europe, India and US**
- **Africa and South-East Asia will emerge as large markets**
- **Off-grid installations will grow faster than grid-connected installations**

## **Required:**

- **Grid Management**
- **World-wide Emission Trading**

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- **Current Status**
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- ✓ **Growth of PV electricity installations is much faster than predicted by most scenarios**
- ! **Adaptation of current grid structures to accommodate larger share of de-centralised RES is needed to enable a large scale use of PV electricity.**
- ✓ **Only increasing markets ensure that PV electricity prices are continuously declining**
- ! **For the next decade solar PV will still need support**
- ✓ **Photovoltaics is one of the most important building blocks for decentralised rural electrification**
- ! **PV electricity is an important building block to realise a decarbonised energy supply**

Photo by Steve Locke

Thank you for your attention!

