



**Is the European industry ready?  
How did the industry develop through  
EU policies and what should we  
expect in the future?**

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## OUTLINE

- Who is EPIA?
- Market Situation
  - Europe
  - Globally
- Perspectives: Competitiveness – European Policy



## WHO is EPIA?

**EPIA represents 95% of the photovoltaic European industry**

- Exists since 1985
- 120 members: 106 full + 18 associate
- 124 full members : manufacturers on the overall value chain
- Budget 2007: 2.4 millions € (54% Members, 31% Sponsorship, Partnerships and new businesses, 15% EC)
- Secretariat in Brussels 10 people in 2007
- 8 Board members elected for 4 years

| Components manufacturers (57)  | Systems, Consulting, R&D (45)   |
|--|---|
| Full Members (57)  | Full Members (27)   |
| <p>aleo Solar (DE), Applied Materials (DE), Atersa (NL), Arcelor (LU), August Krempel (DE), Baoding Yingli (CN)</p> <p>Bangkok Solar (TAI), Bisol (SI), BP Solar (ES), CEEG PV (CN), Crystalox (UK), DC Chemicals (DE), Dow Corning Europe (BE), DuPont (FR), Elkem Solar (NW), Energy Solutions (BG), Enersys (UK), EniPower (IT), ErSol Solar Energy (DE), Evergreen Solar (DE), First Solar (DE), Fronius (AU), Guardian (US), HCT Shaping Systems (CH), Helianthos (NL), Honeywell Specialty Materials (BE), Isofoton (ES), Isovolta (AU), KACO Gerätetechnik (DE), Konarka (US), KPE (KR), Kyocera (DE), Leybold Opticqs (DE), Meyer + Burger (CH), Mistubishi Electric Europe (DE), Multi-Contact (CH), MSK (UK), OC Oerlikon Balzers Ltd. (LS), Photovoltech (BE), Photowatt Internatioal (FR), Pillar (UA), Podolsky Chemical (RU), PowerLynx (DK), PV Silicon (DE), Q-Cells (DE), Samsung Deutschland (DE), Sanyo Component Europe (DE), REC Scanwafer (NW), RENA</p> <p>Sondermaschinen (DE), Renergies (IT), Saft (FR), Saint Gobain (FR), Schott Solar (DE), Scheuten Solar (NL), Sharp Solar Systems (DE), Shell Solar (NL), SGL Carbon (DE), Siemens (DE), Solar Cells Hellas (GR), SMA Technologie (DE), Solland Sollar Energy (NL), Solar Century (UK), Solar World (DE), Solvay Solexis (BE), Sputnik Engineering (CH), Stangl Semiconductor Equipment (DE), Sunways (DE), Sunpower (US), Suntech Power (CN), Topsil (DK), Trina Solar (ES) Vesuvius (FR), Wacker-Chemie (DE), VON ARDENNE (DE), United Solar Ovonic Europe (DE) Würth Solar (DE)</p> | <p>3S Swiss Solar Systems (CH), Acciona Solar (ES), Carmanah (UK), City Solar (DE), Conergy (DE), Econcern (NL), Ecotecnia (ES), Engcotec (DE), ESI (DE), Goldbeck Solar (DE), GP Solar (DE), IBC Solar (DE), IB Vogt (DE), IT Power (UK), M+W Zander (DE), NAPS Systems (FI), NaRec Development Services (UK), Phönix SonnenStrom (DE), Powerlight Systems (CH), Saft Power Systems (FR), Solar Ventures (IT), Solar Electric (FR), Solaria Energia (ES), Tenesol (FR), Wager &amp; Co Solartechnik (DE), WIP (DE)</p> |
|  | Associate Members (18)  |
|  | <p>ADEME (FR), Apollon Solar (FR), APREN (PT) Belval (CH), CRES (GR), Dexia (FR), ECN (NL), EDF (FR), Trama (ES), Fraunhofer (DE), IM2 Systems (ES), IMEC (BE), INES (FR), Kosolco (DE), Observ'ER (FR), REECO (DE), SEMI (US), SHV (NL)</p>  |



## Current global state of PV

For small scale, stand alone applications, it is often the least cost option for a given energy service need

Grid-connected applications is the largest market segment due to feed in tariff programs

Annual growth rate of cumulative installed PV has been relatively stable since 2000 at ~35% per year

Heavy investment is undertaken by the private sector in order to meet the growing demand and to lower the costs (50.000 jobs in Europe)

Global PV market value of 9 billion € in 2006

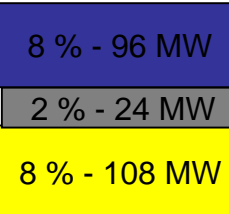


# Market Segments

## Off-Grid Industrial



## Consumer

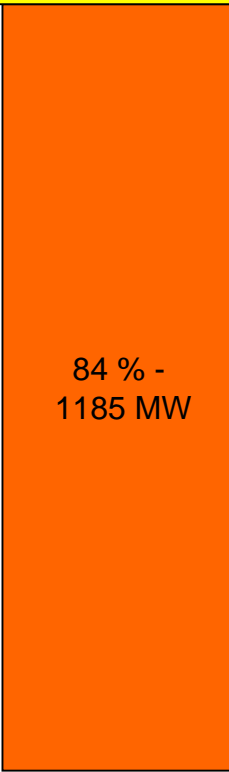


Economically viable

## Off-Grid Residential



## On-Grid



Dependant on market support programs

Source: Strategies Unlimited - EPIA



# EU 25 Market 2006

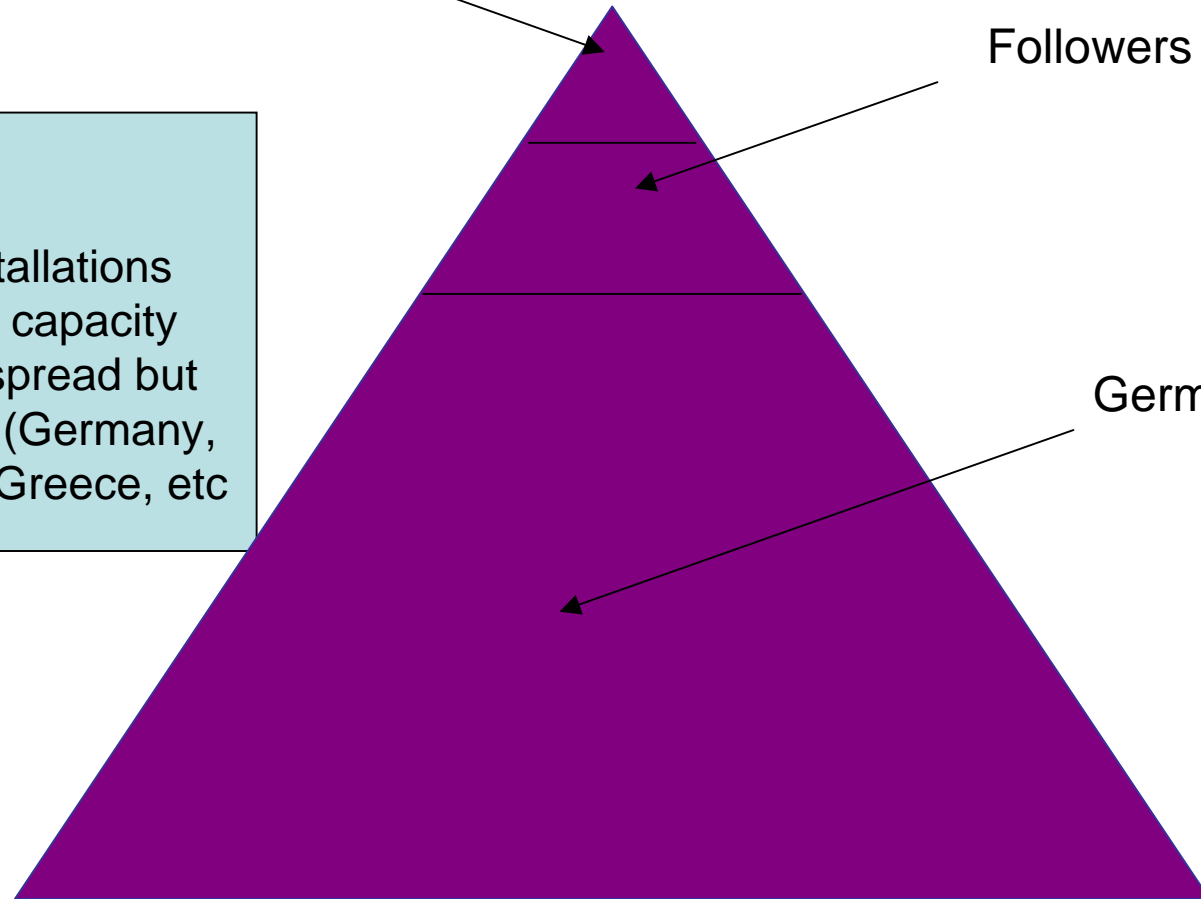
Less developed markets

Followers

Germany

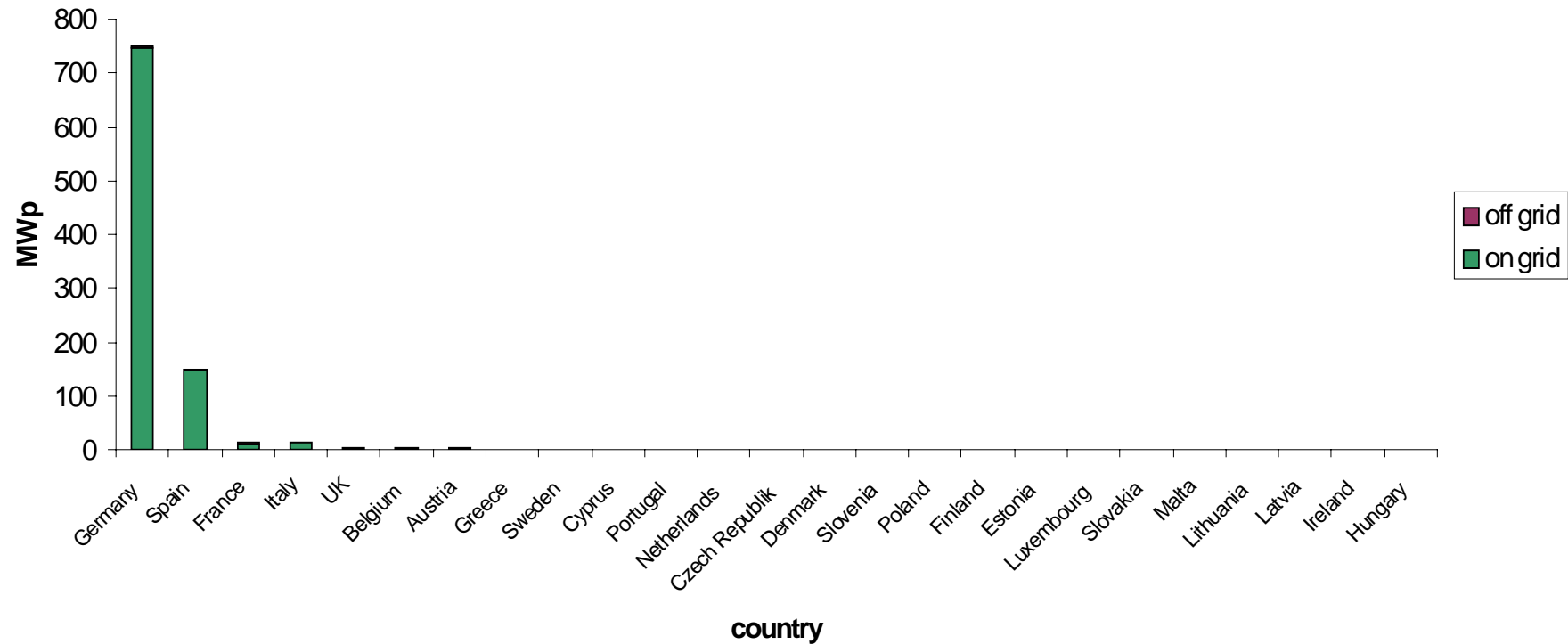
## KEY DATA

- 930 MWp annual installations
- 3 GWp accumulative capacity
- Feed in tariff widely spread but different approaches (Germany, Spain, Italy, France, Greece, etc)





# Annually Installed PV in EU 25 - 2006

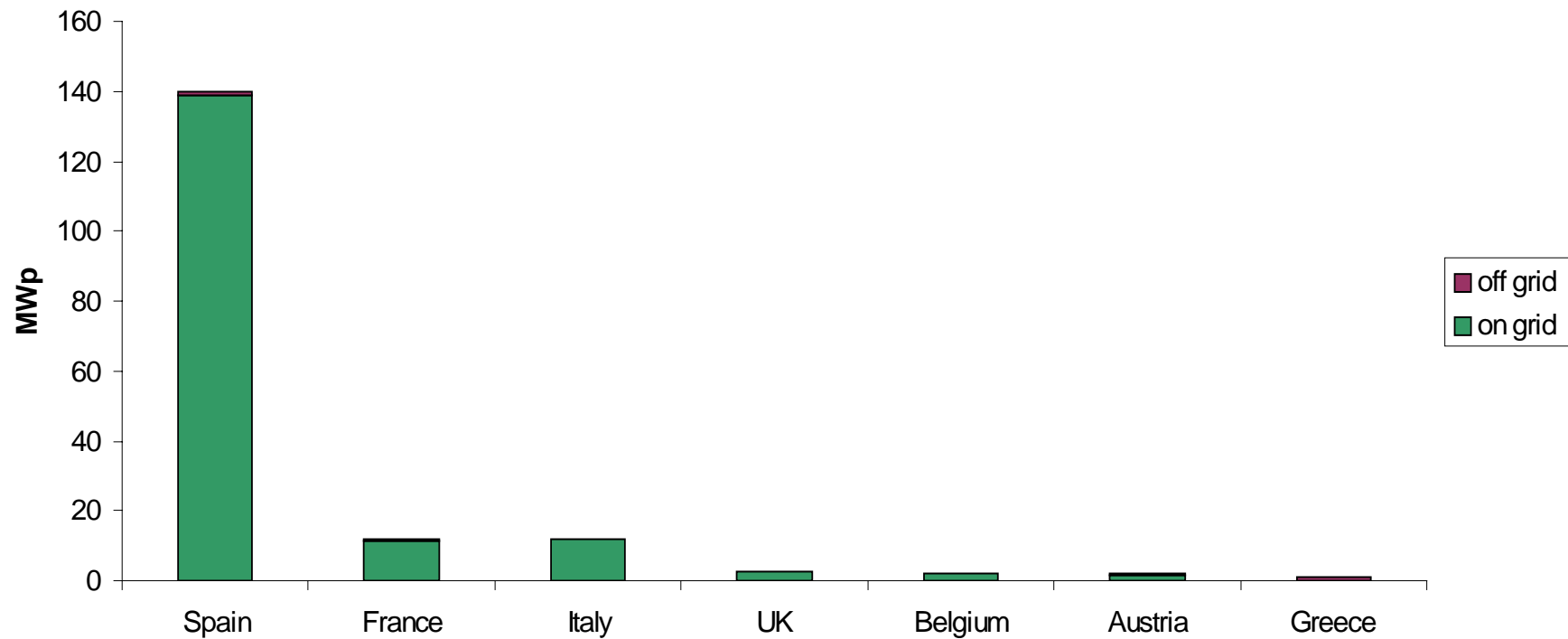


source: EurObserver, BSW





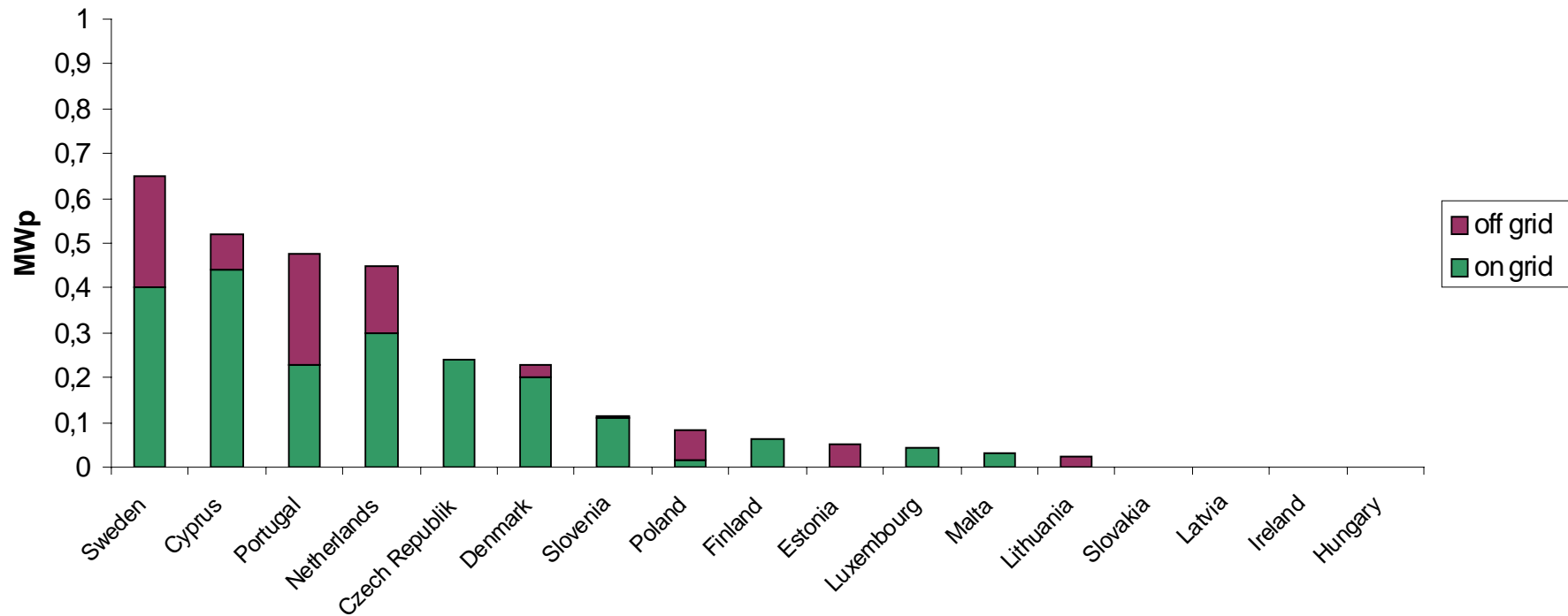
## Annually Installed PV in EU 25 – 2006 “Followers”



source: EurObserver



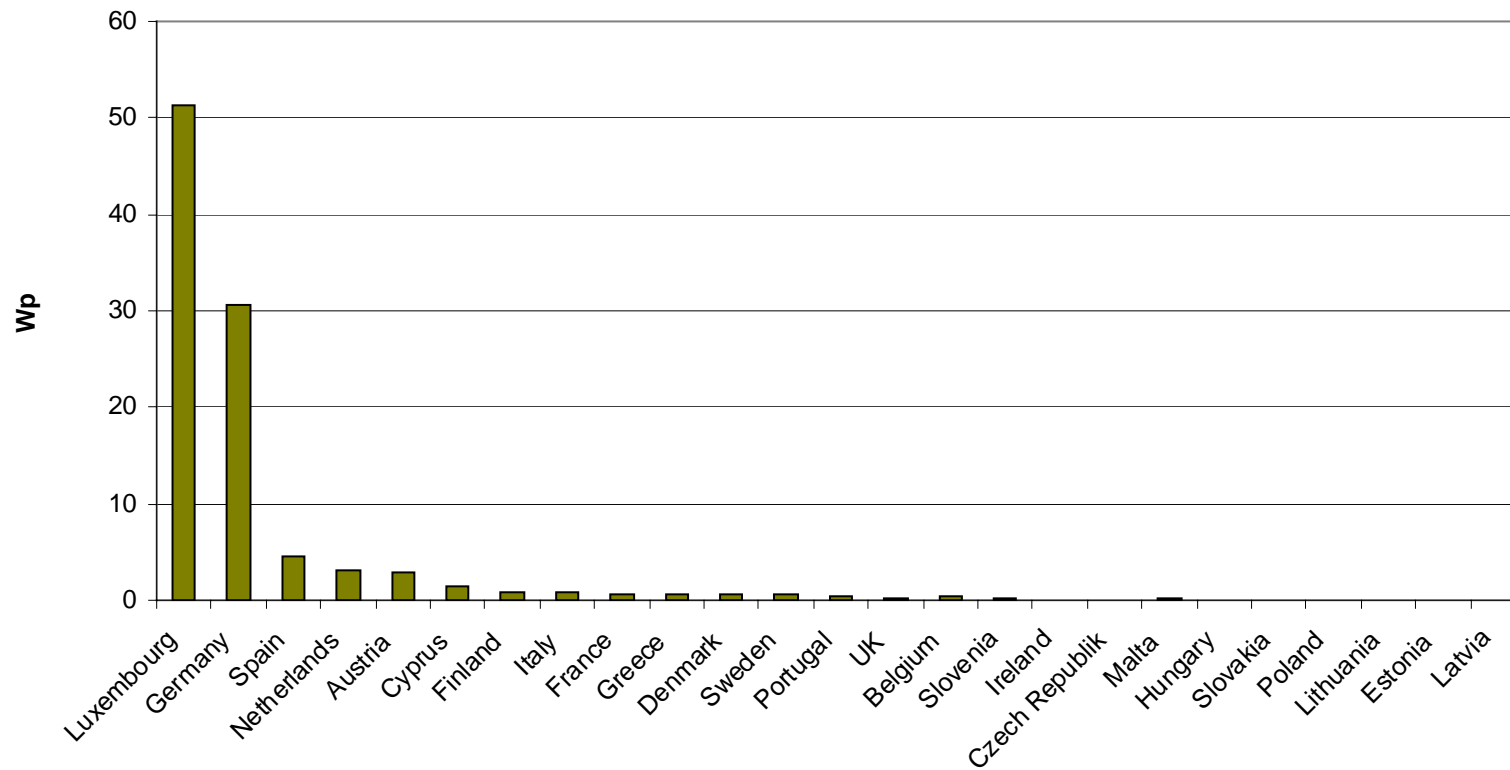
## Annually Installed PV in EU 25 – 2006 “Less developed or small markets”



source: EurObserver

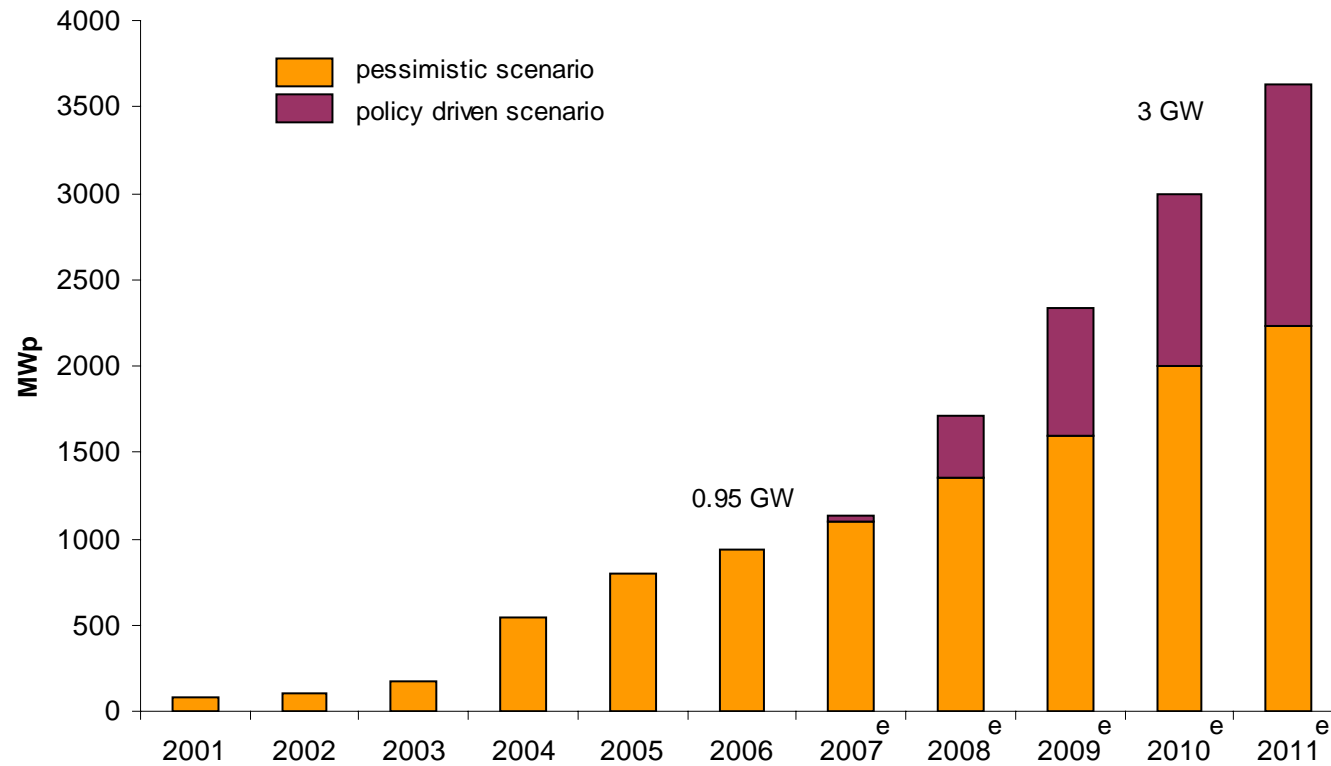


# Wp per Capita



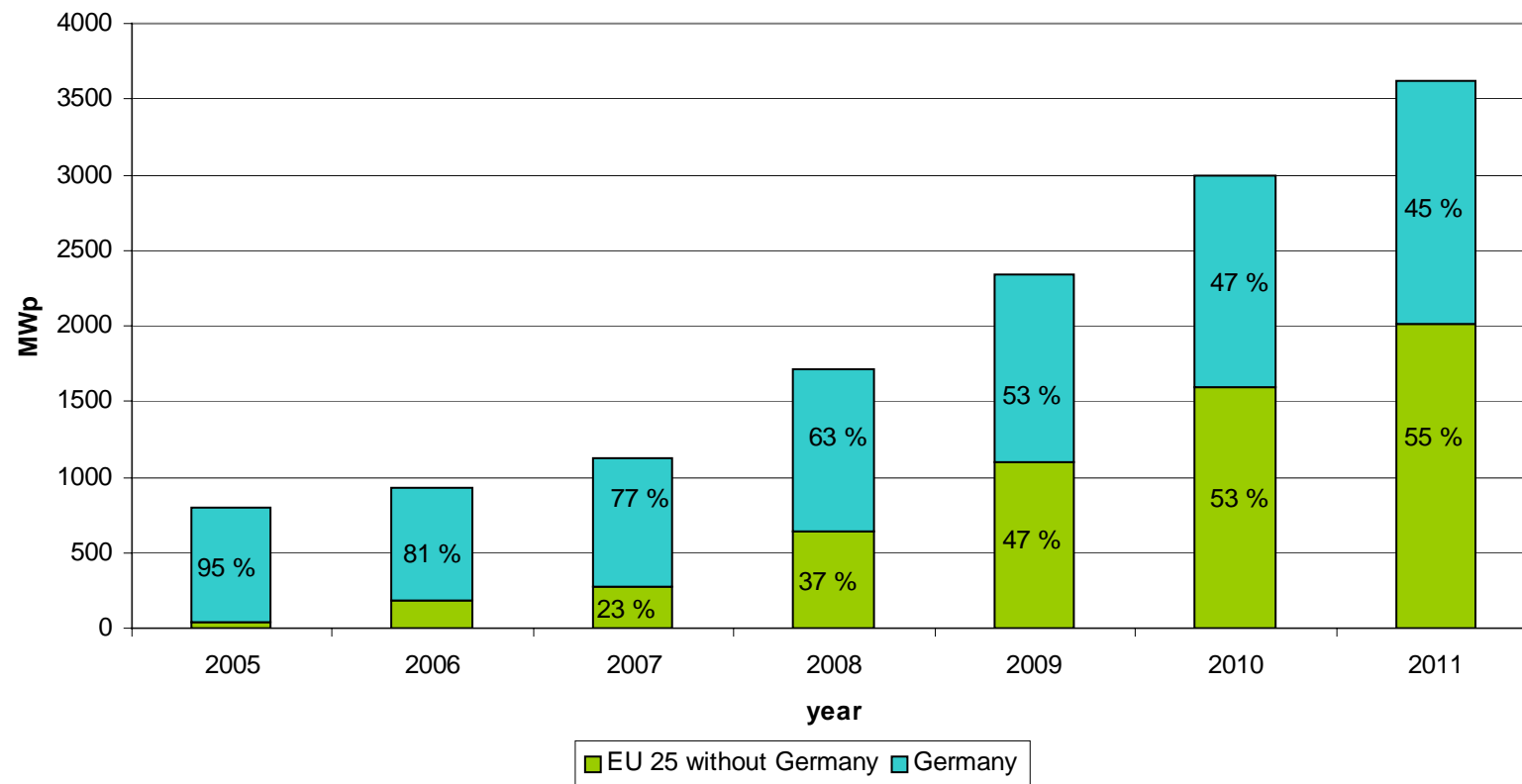


# EU - 25 (27) Annual Installations of PV





## EU 25 (27)- Annual Market with and without Germany





# Development of the German PV-market

**1991: Electricity Feed-In Act**  
 Right of  
 (1) of grid access  
 (2) feed-in of solar electricity  
 (3) refund payment at fixed prices  
 (approx. 8.5 €ct per kWh)

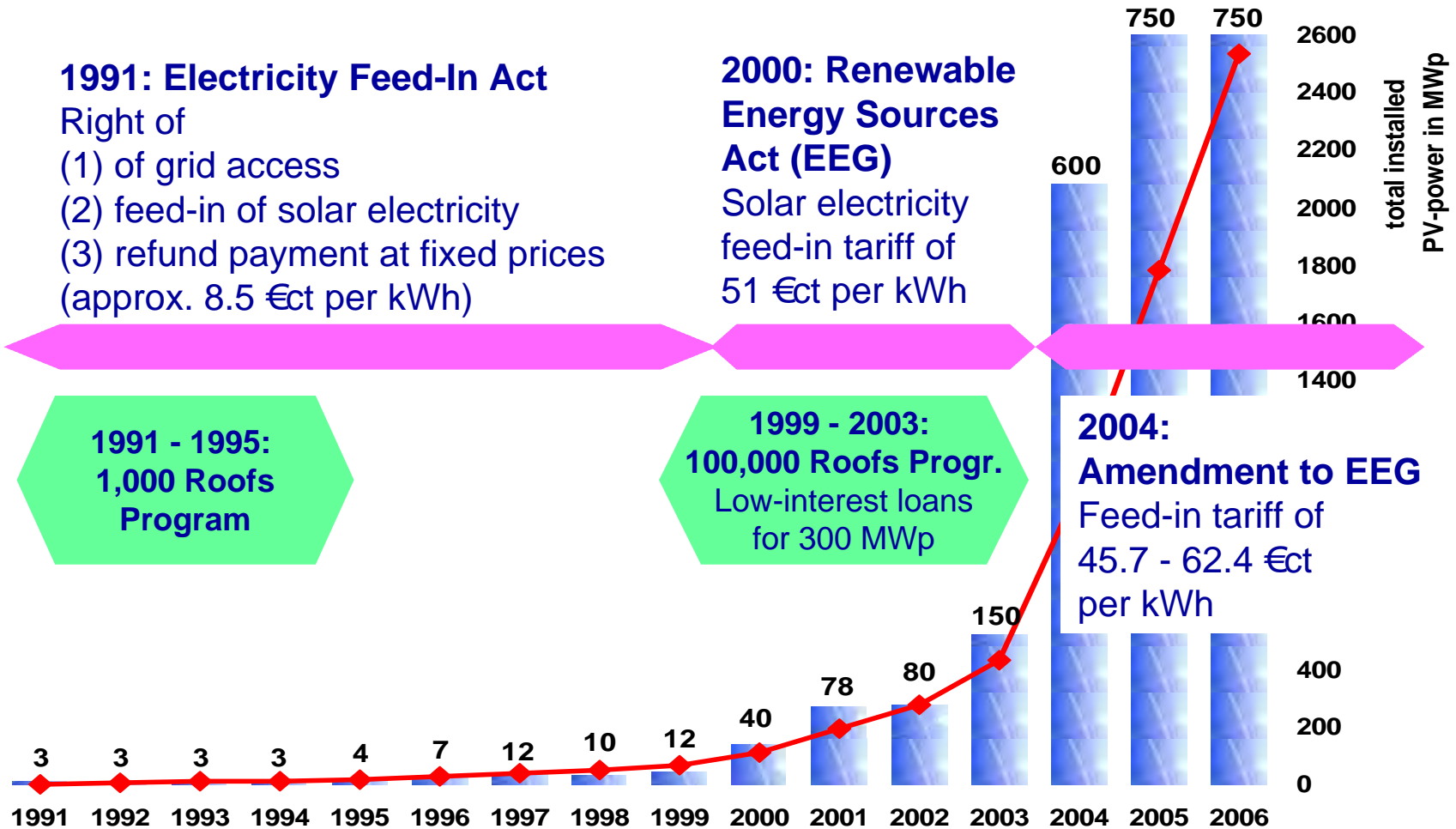
**2000: Renewable Energy Sources Act (EEG)**  
 Solar electricity feed-in tariff of 51 €ct per kWh



**1991 - 1995: 1,000 Roofs Program**

**1999 - 2003: 100,000 Roofs Progr.**  
 Low-interest loans for 300 MWp

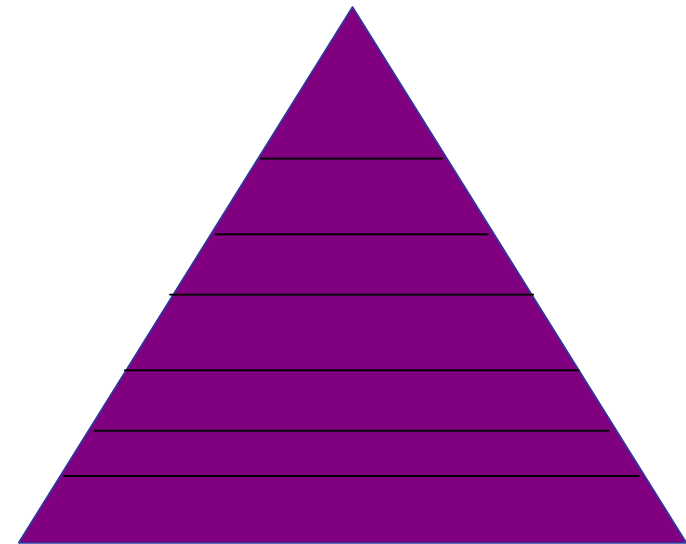
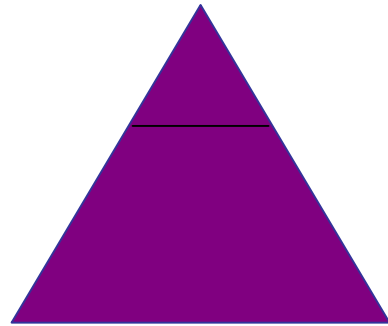
**2004: Amendment to EEG**  
 Feed-in tariff of 45.7 - 62.4 €ct per kWh



■ annually installed PV power in MWp    ◆ total installed PV power in MWp  
 Energy Week, Athens, 26 October 2007



# Diversification of European and Global Market

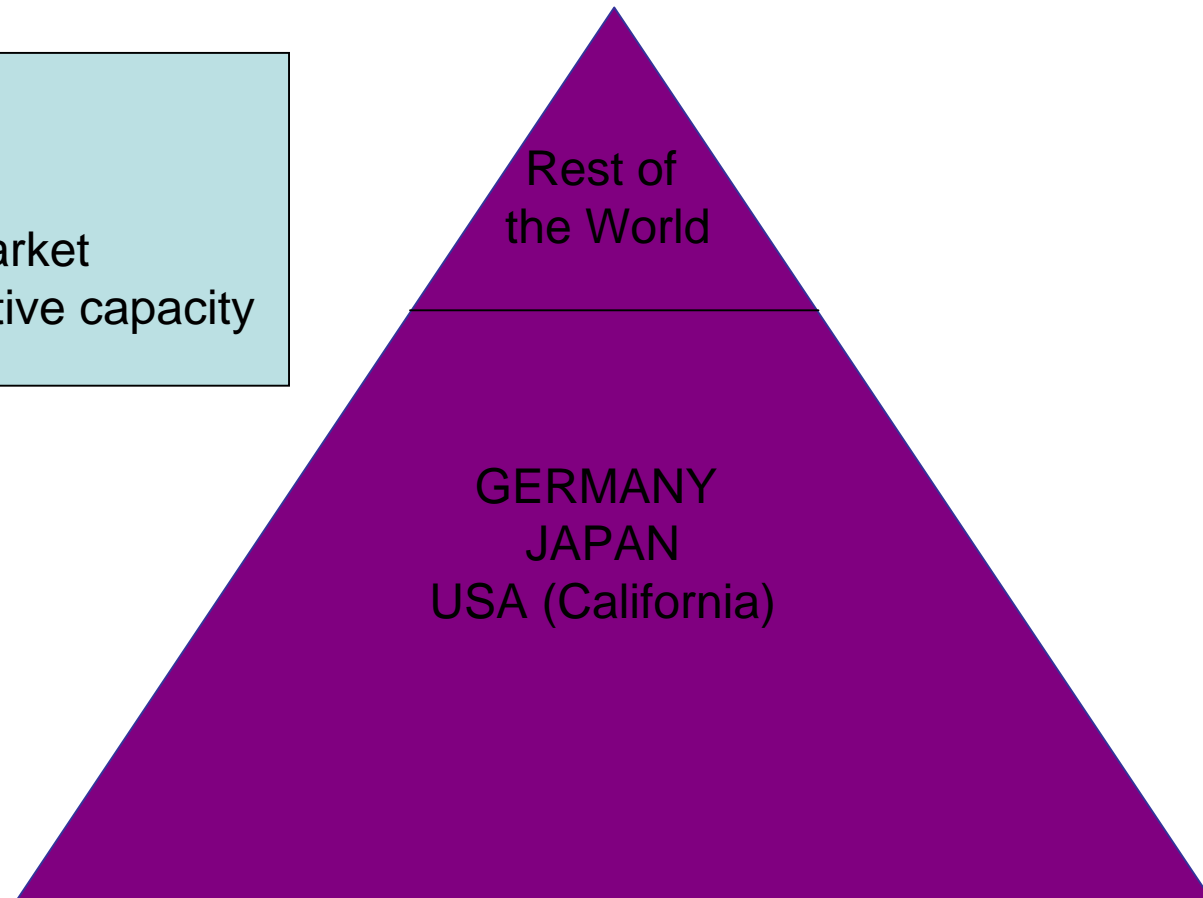




## Global Market 2006

### KEY DATA

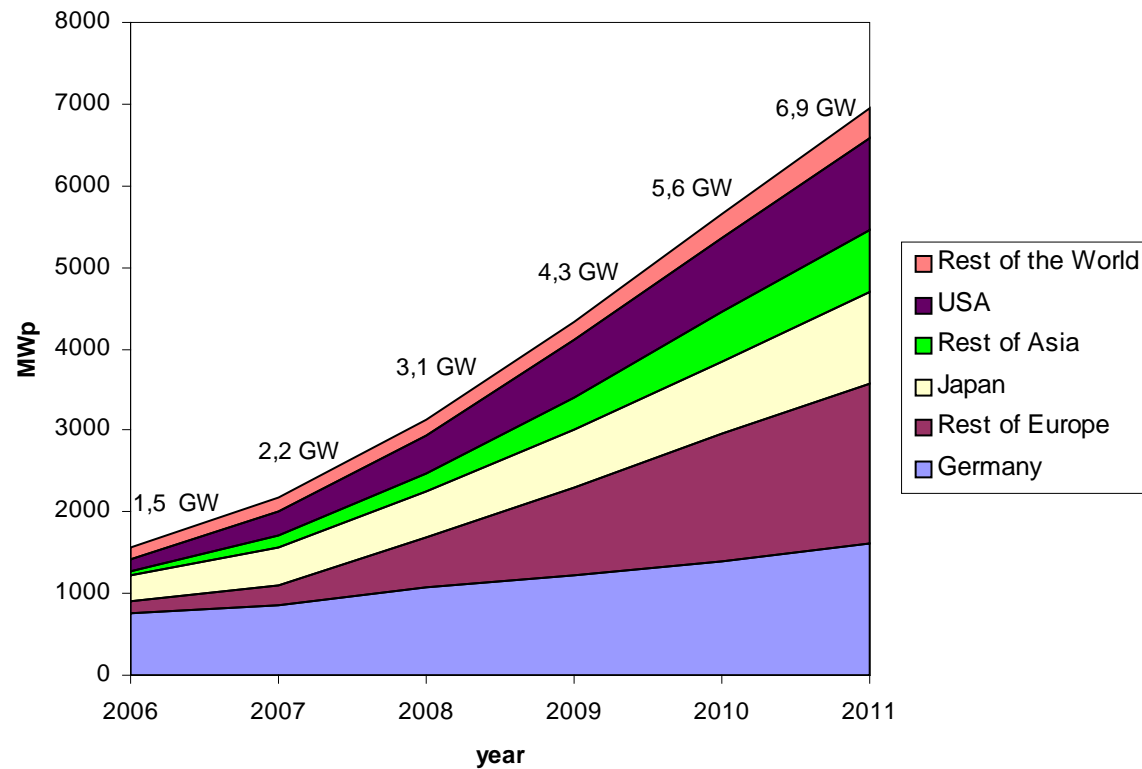
- 1.5 GWp annual market
- 6.5 GWp accumulative capacity





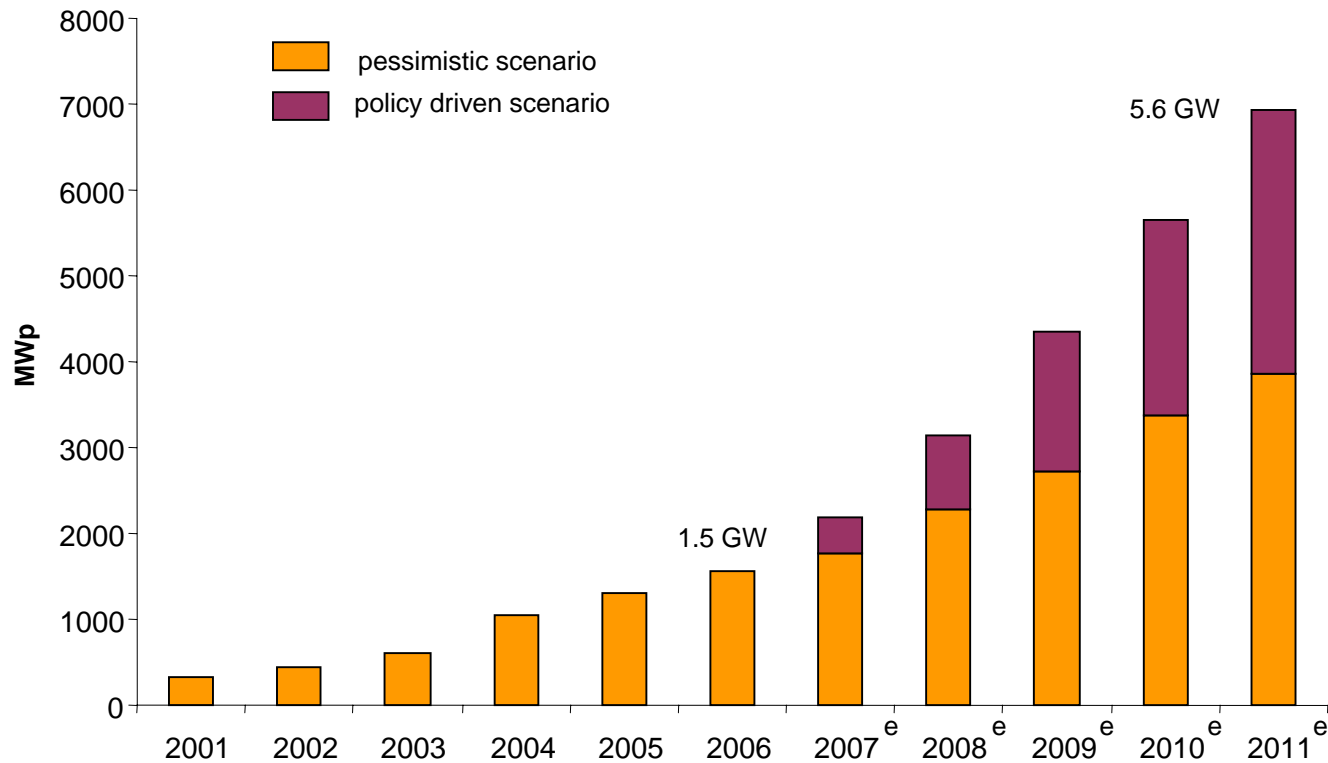


# Global Annual Installations





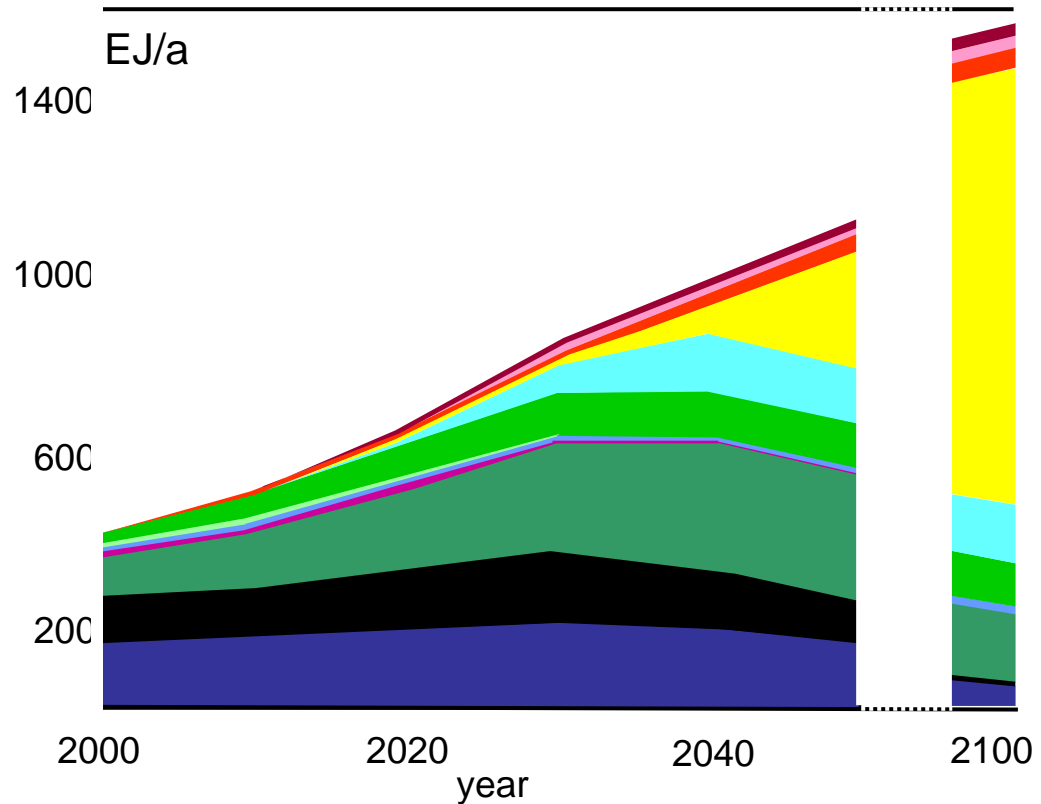
# Global Annual Installations of PV





## Solar Energy and the energy transition

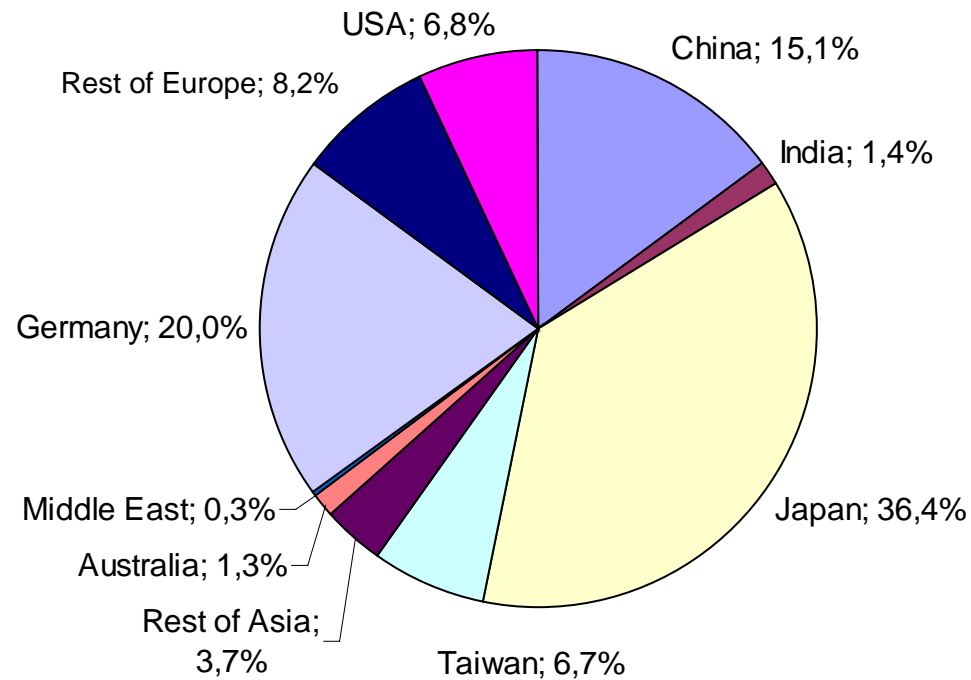
- geothermal
- other renewables
- solar thermal (heat only)
- solar power (PV and solar thermal generation)
- wind
- biomass (advanced)
- biomass (traditional)
- hydroelectricity
- nuclear power
- gas
- coal
- oil



Source: German Advisory Council on Global Change, 2003, [www.wbgu.de](http://www.wbgu.de)



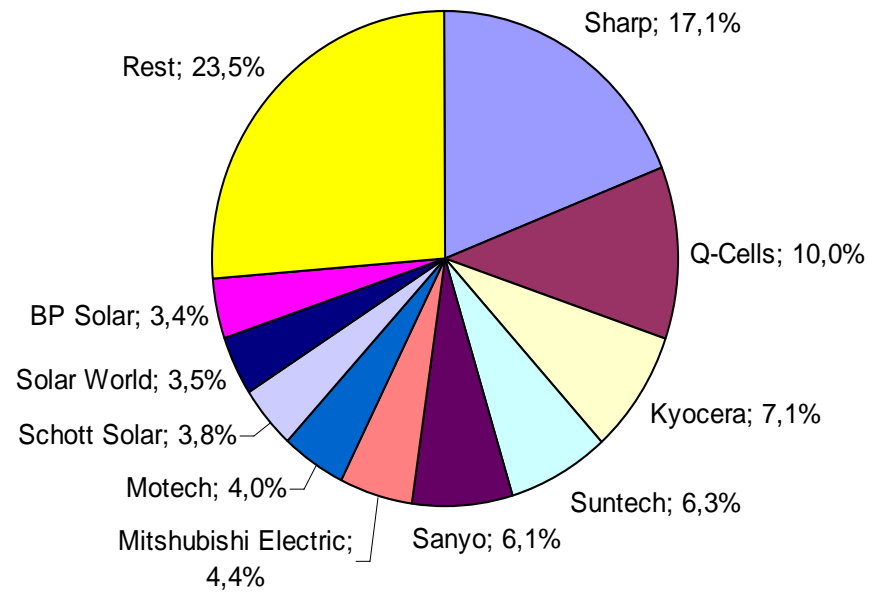
# Cell Production Shares per Region 2006



source: Photon 2007/3



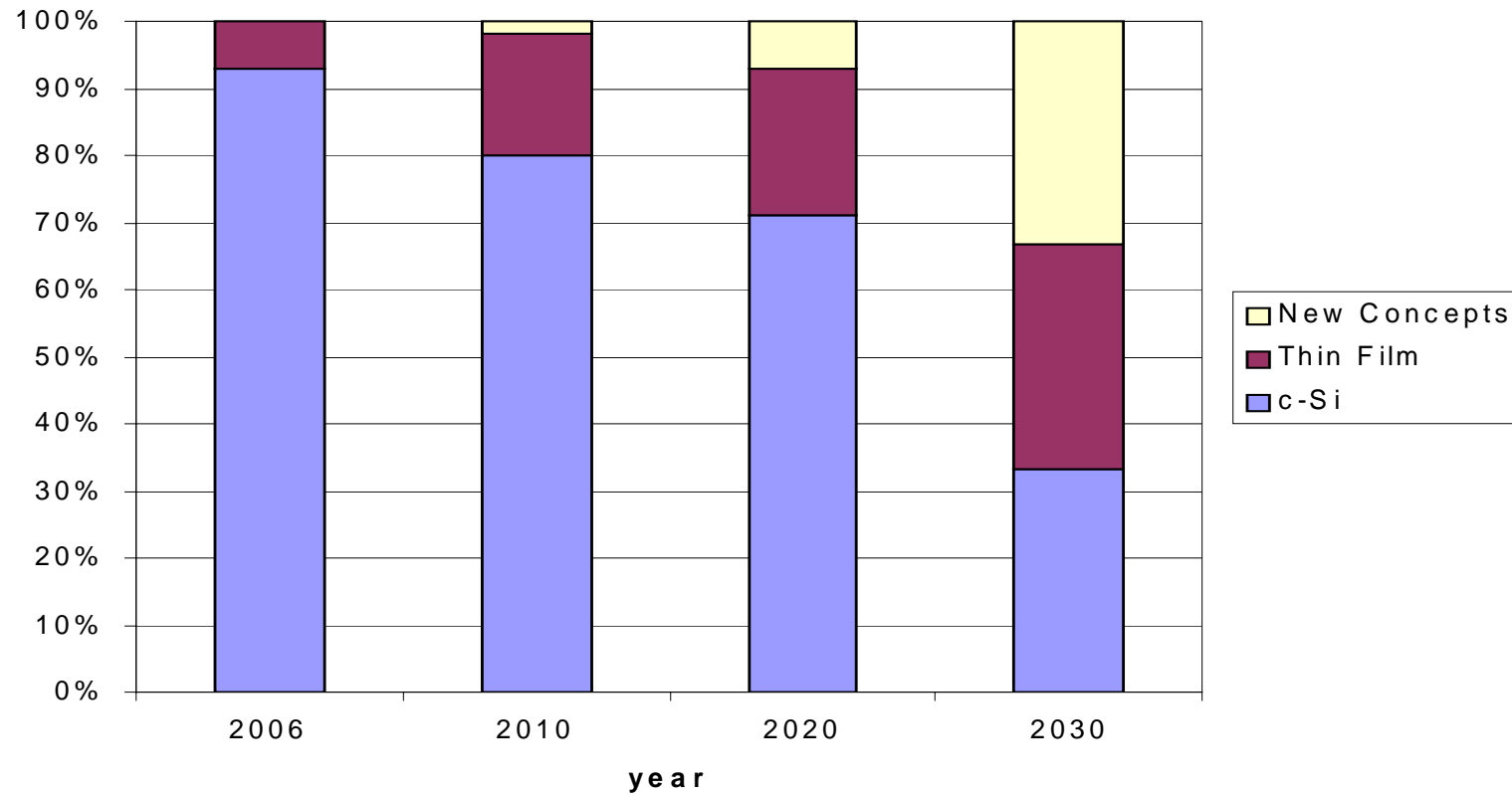
# Market Leaders in 2006



source: Photon 2007/3



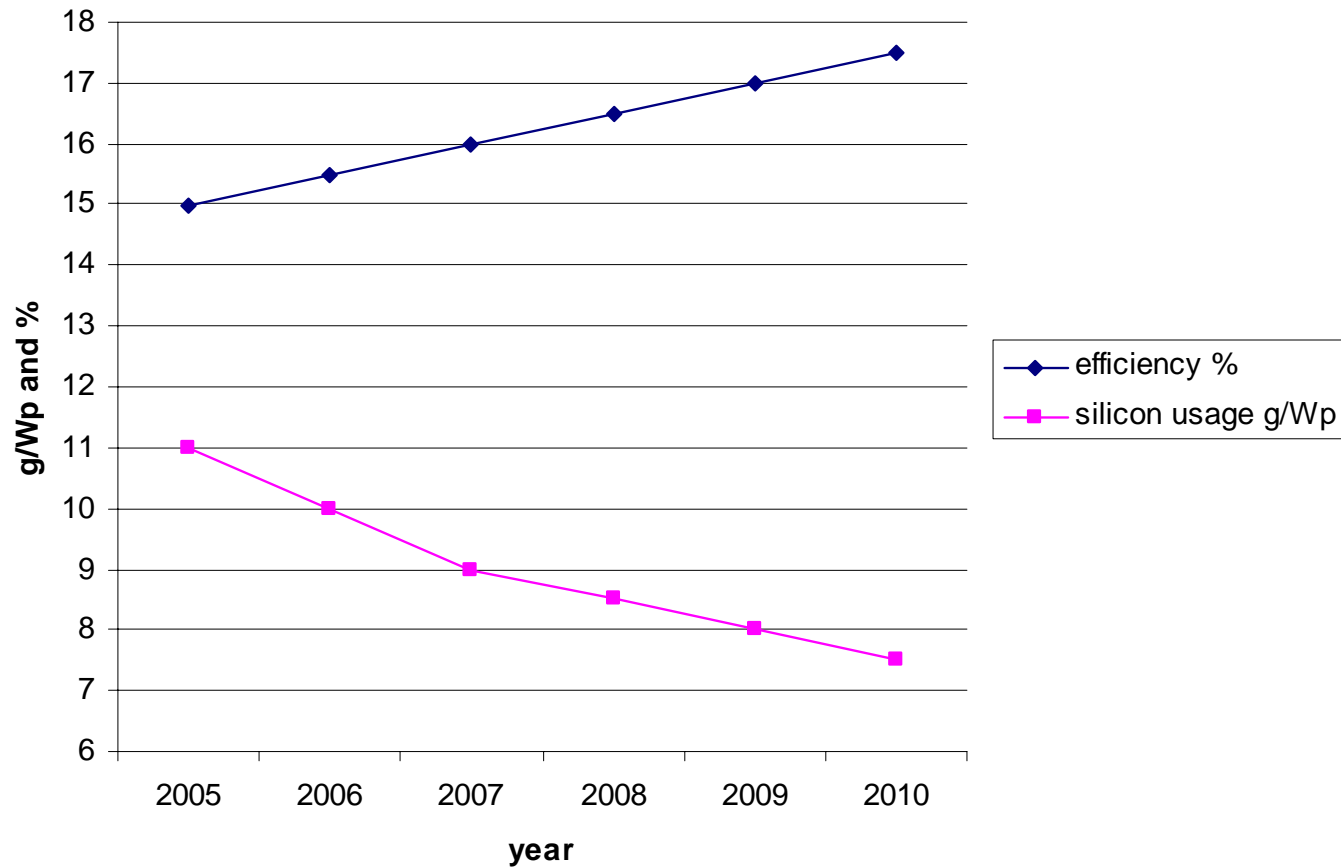
# Relative Share of Technology over Time



source: EPIA



## Module Efficiency and Silicon Consumption - one of several drivers to competitiveness



source: EPIA



| Radiation                       | PV costs per kWh |
|---------------------------------|------------------|
| 900 h/a (Germany)               | ~ 0.40 €         |
| 1800 h/a (very south of Europe) | ~ 0.20 €         |



**Residential electricity prices in Europe = 0,10 – 0,20 €**



**PV system prices are decreasing by at least 5 % annually. With a stronger growing industry even faster (technological advance, economies of scale)**

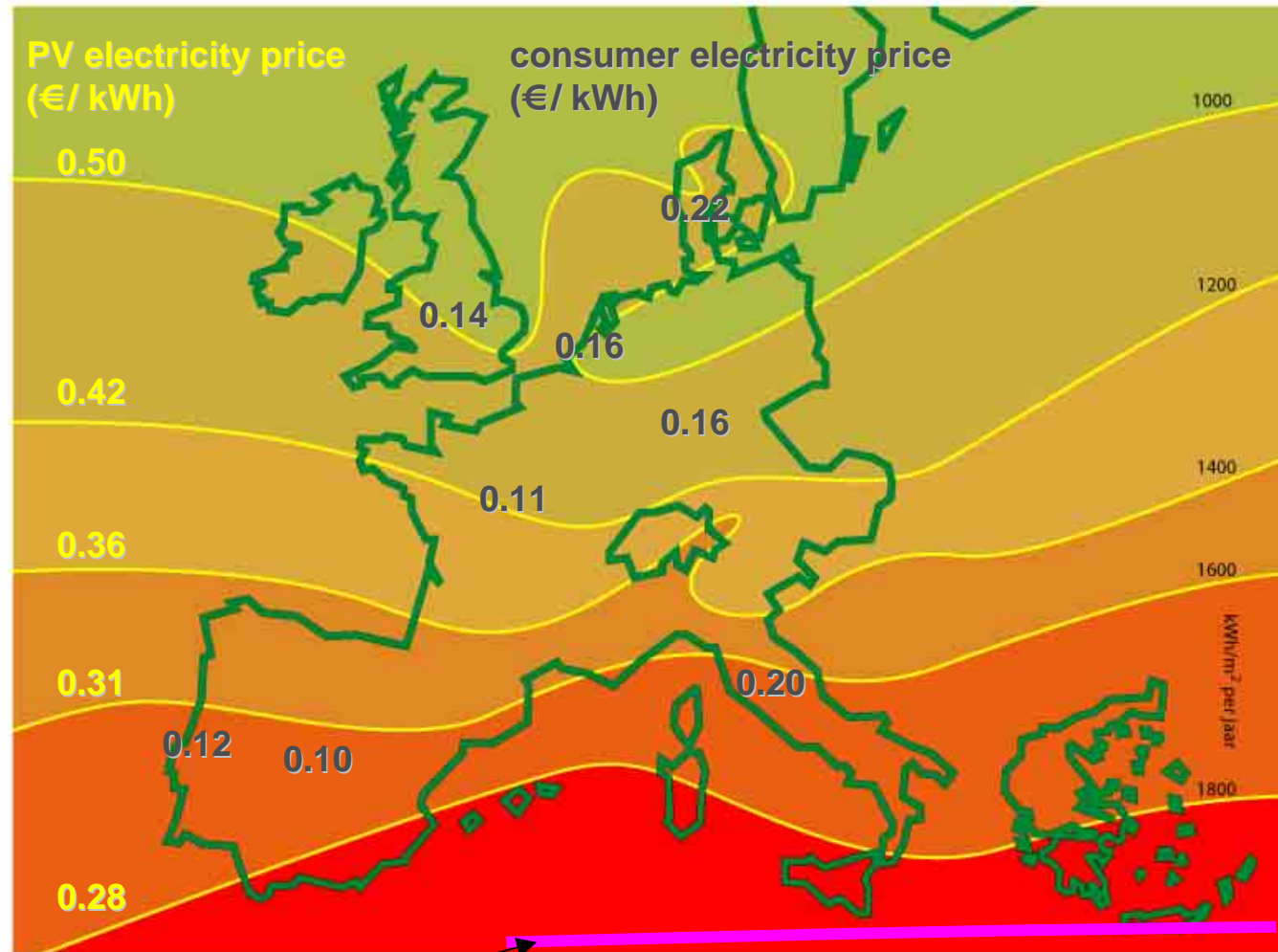
**Residential electricity prices and energy prices in general are expected to increase**





2005

PV electricity prices compared with typical consumer electricity prices

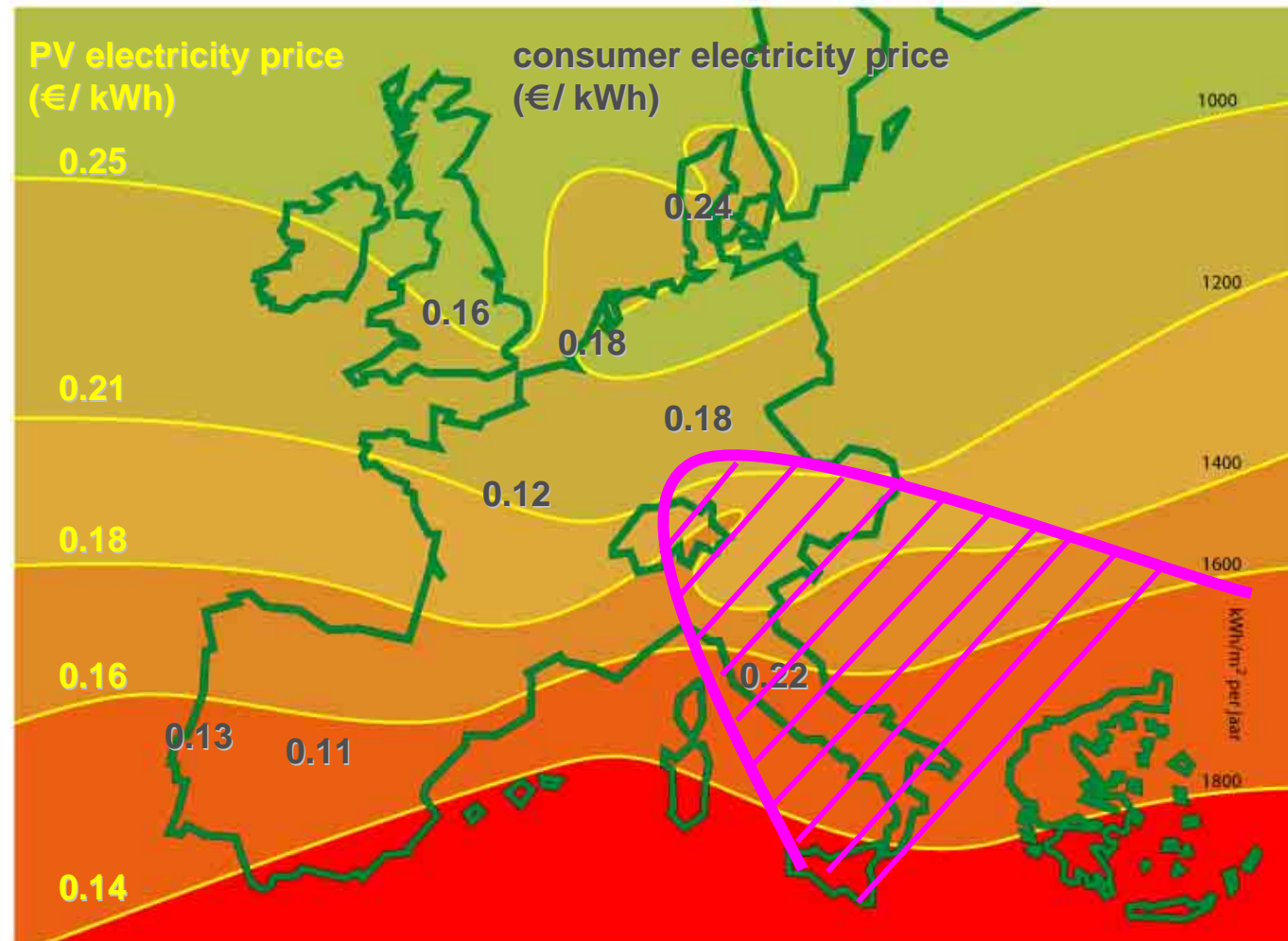


break-even boundary



2015

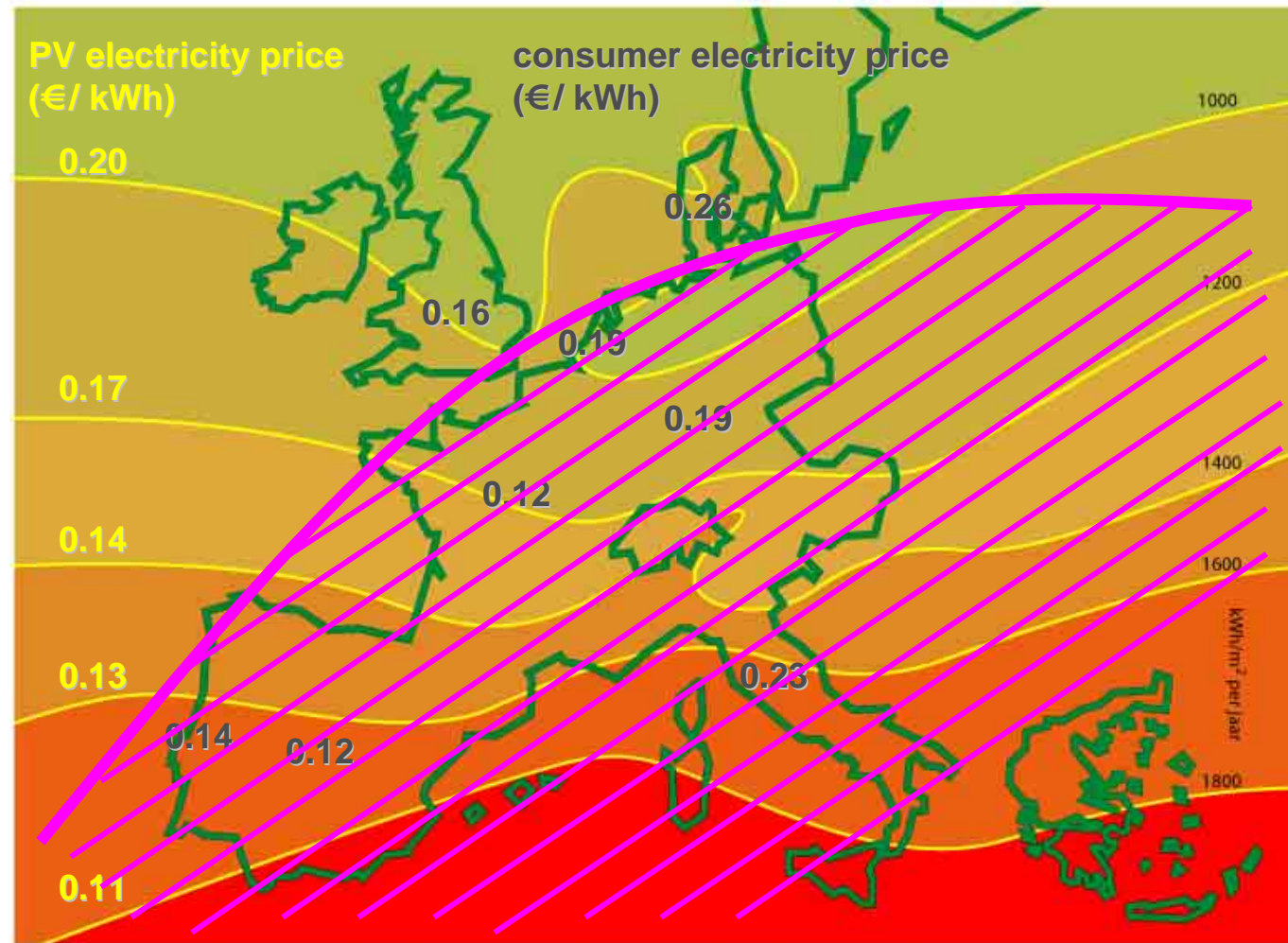
**PV electricity prices compared with expected consumer electricity prices (+ 1%/yr)**





# 2020

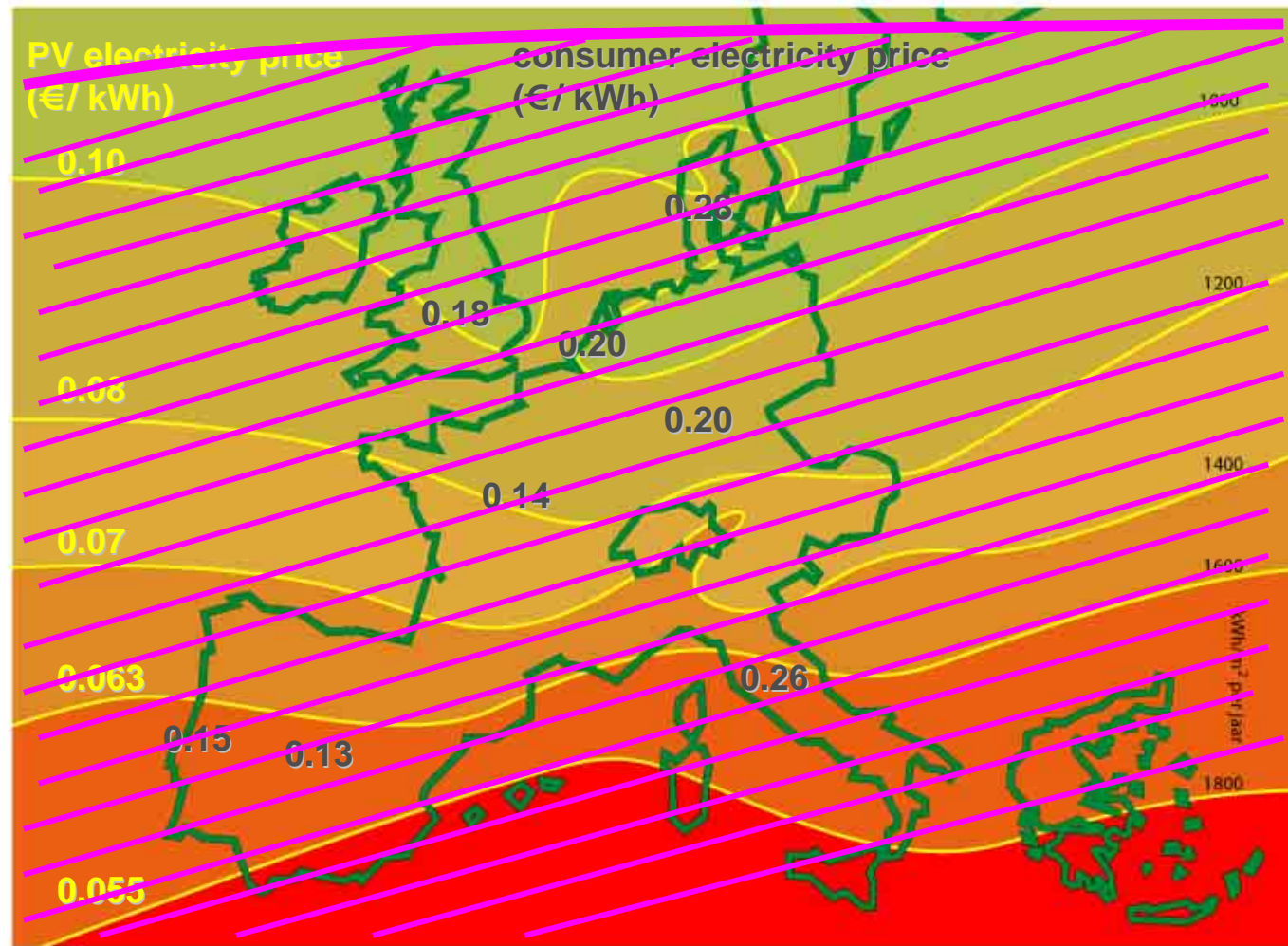
**PV electricity prices compared with expected consumer electricity prices (+ 1%/yr)**








# 2030

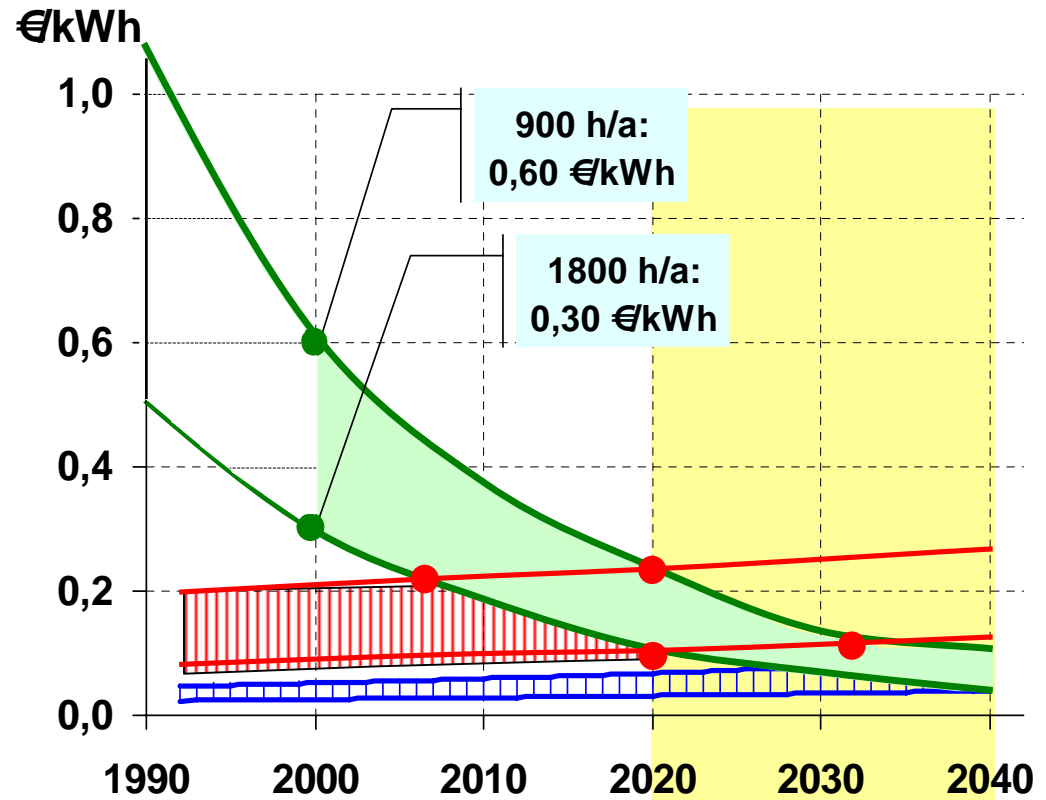
**PV electricity prices compared with expected consumer electricity prices (+ 1%/yr)**





## Competitiveness between Electricity Generating Costs for PV and Utility Prices

-  Photovoltaics
-  Utility peak power
-  Bulk power



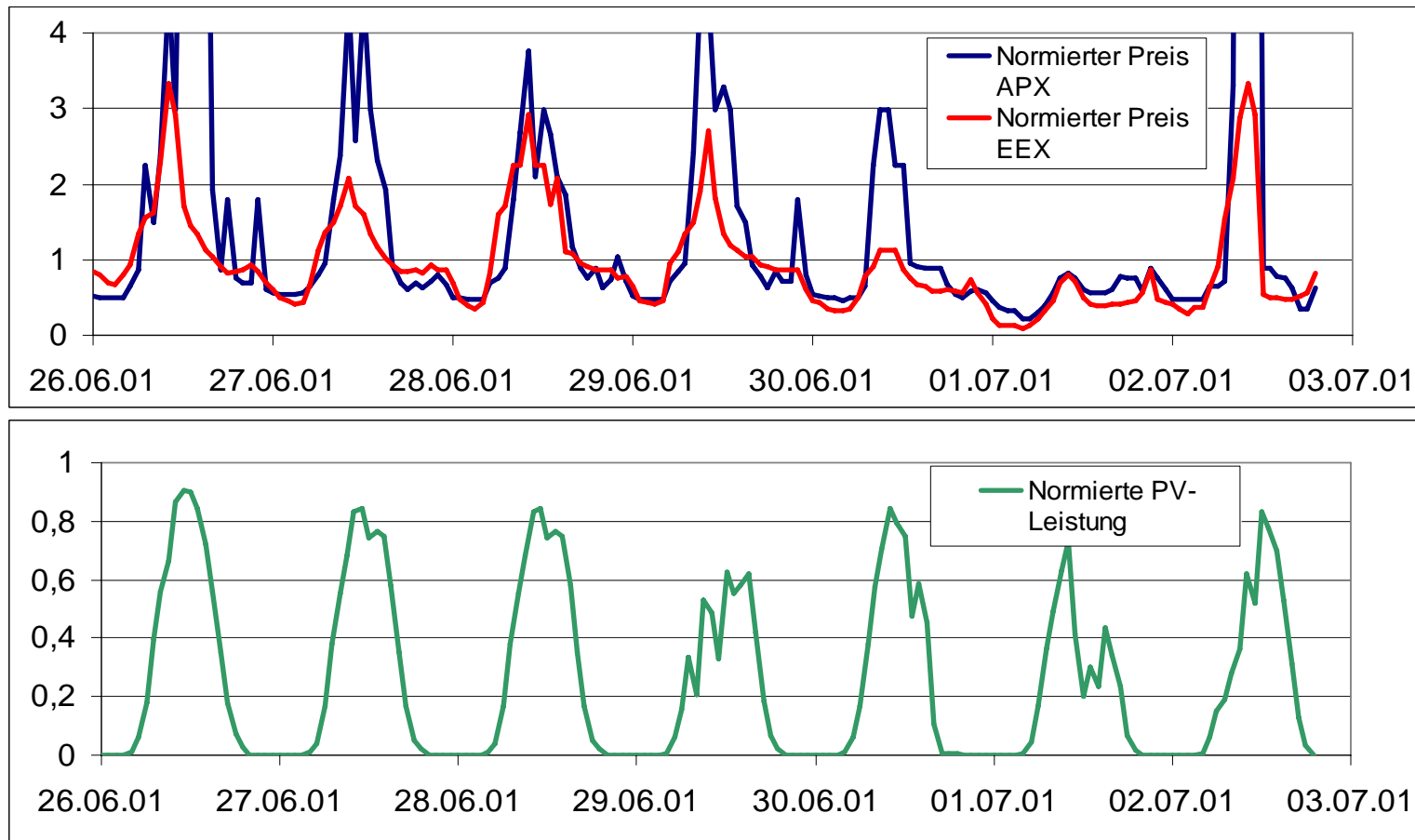
market support programs necessary:



Source: RWE Energie AG and RSS GmbH



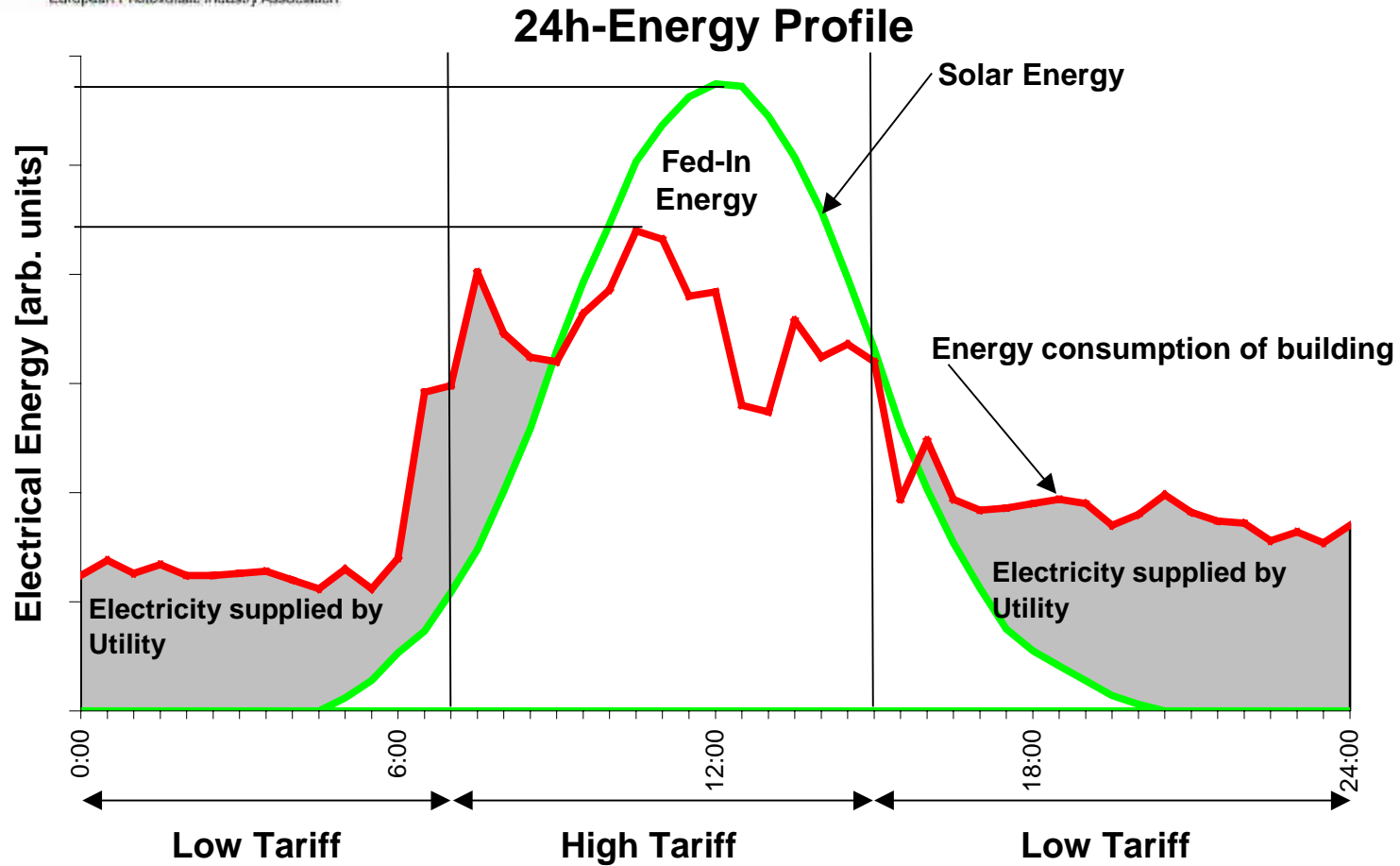
# Correlation of PV and Spot Market prices



Source: Fraunhofer

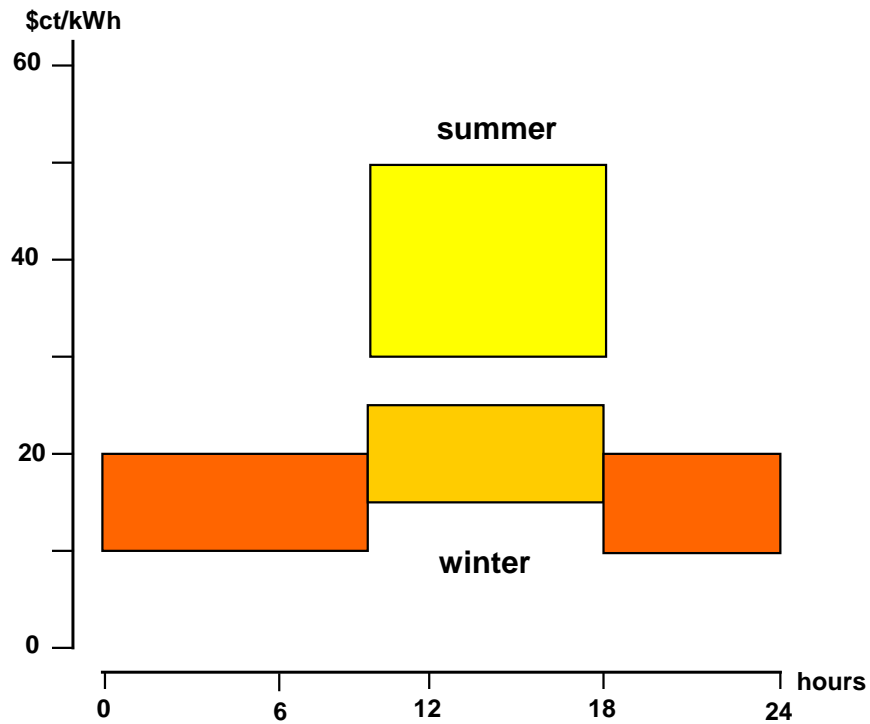


# Daily profile of solar energy production and energy consumption of an office building





## Competitiveness – California



**Range of Electricity Prices in California** (data from Alison Hyde, BSW)





# Future European Legal Framework

## New Framework Directive on renewable energy sources (Proposal to be submitted by the EC in January 2007)

- increases the share of renewables in EU energy mix from 6.5% today to 20% by 2020 (binding target for renewable in the overall energy mix)



## Current discussion

**Some countries fear that they can not reach their targets**

**Strong forces for trading of renewable electricity**

**Dangerous:**

**Undermine Feed in Tariff schemes**

**Expensive (UK wind energy is much more expensive than in GER)**

**Does not work (Spain and Germany are the leaders with FiT)**

**Particular danger for PV**

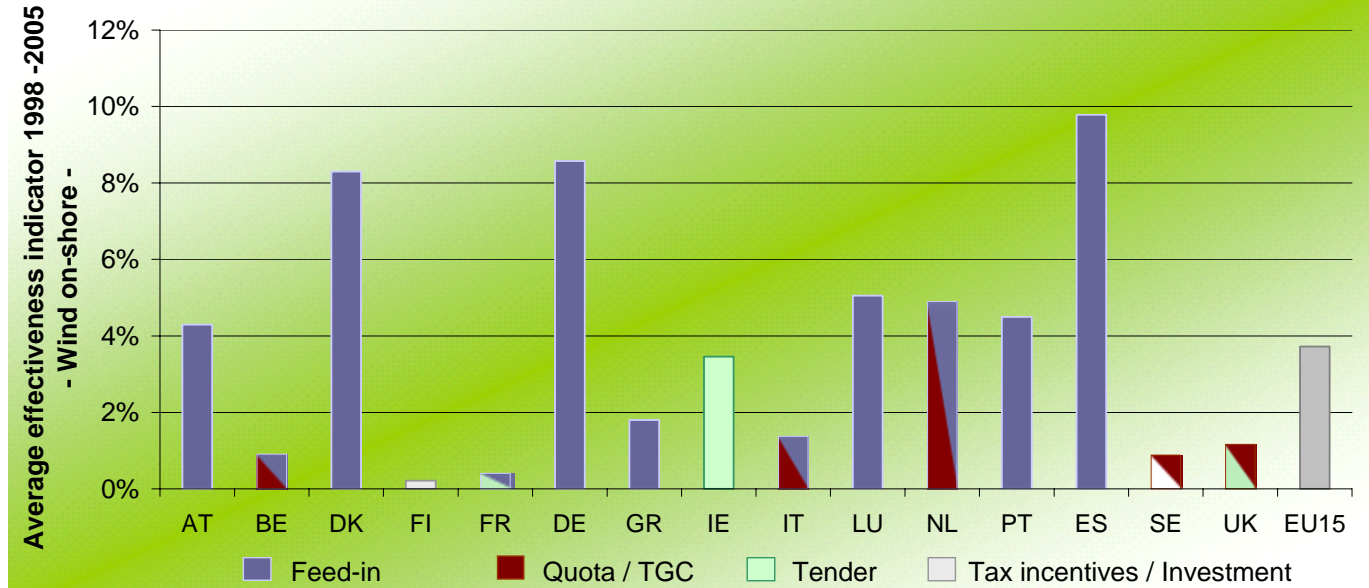
**More buyers but not sellers**

**etc.**

**Greek support is needed in this current discussion to fight for Feed in Tariff systems!**

# Feed in Tariff Effectiveness

► *Feed-in tariffs have been more successful in terms of resulting RES-E deployment compared to TGC-systems*



$$E_n^i = \frac{G_n^i - G_{n-1}^i}{ADD - POT_n^i} \quad (1)$$

$E_n^i$  Effectiveness indicator for RES technology i for the year n

$G_n^i$  Existing normalised electricity generation by RES technology i in year n

$ADD - POT_n^i$  Additional generation potential of RES technology i in year n until 2020

Source: Energy Economics Group, Fraunhofer Institute



- **Is the European PV Industry ready?**

**Inmature to mature industry**  
**Mass production**  
**Strong capacity upscaling**

- **How has the industry developed due to support programmes?**

**World leading companies**  
**Economies of scale – decrease in production costs**

- **What can we expect in the future due to this support programmes**

**PV will reach grid parity during the next decade**  
**We need those programmes now but only temporary**  
**No market without those programmes**  
**Work together to improve them and show that they work best**



**Thank you very much  
for your attention!**