

# Photovoltaics in Germany

**Sino-German Intl. Solar Energy & PV Projects  
Exhibition and Conference**

May 10-11, 2007

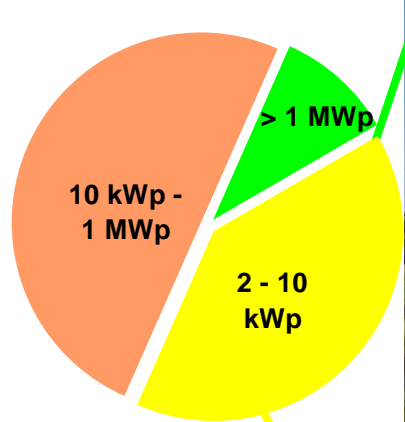
Shanghai Everbright Convention & Exhibition Center

Frank Haugwitz / GTZ



# Use of Photovoltaics in Germany

- More than 300,000 PV systems installed
- 99% of systems grid-connected



10% ground mounted large PV systems > 1 MWp



Image: Voltwerk

50% multi family houses, public and social buildings, farms, commercial plants 10-1000 kWp

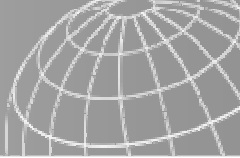


Image: Solarwatt

40% small PV systems on private residential homes 1-10 kWp



Image: Solarwatt

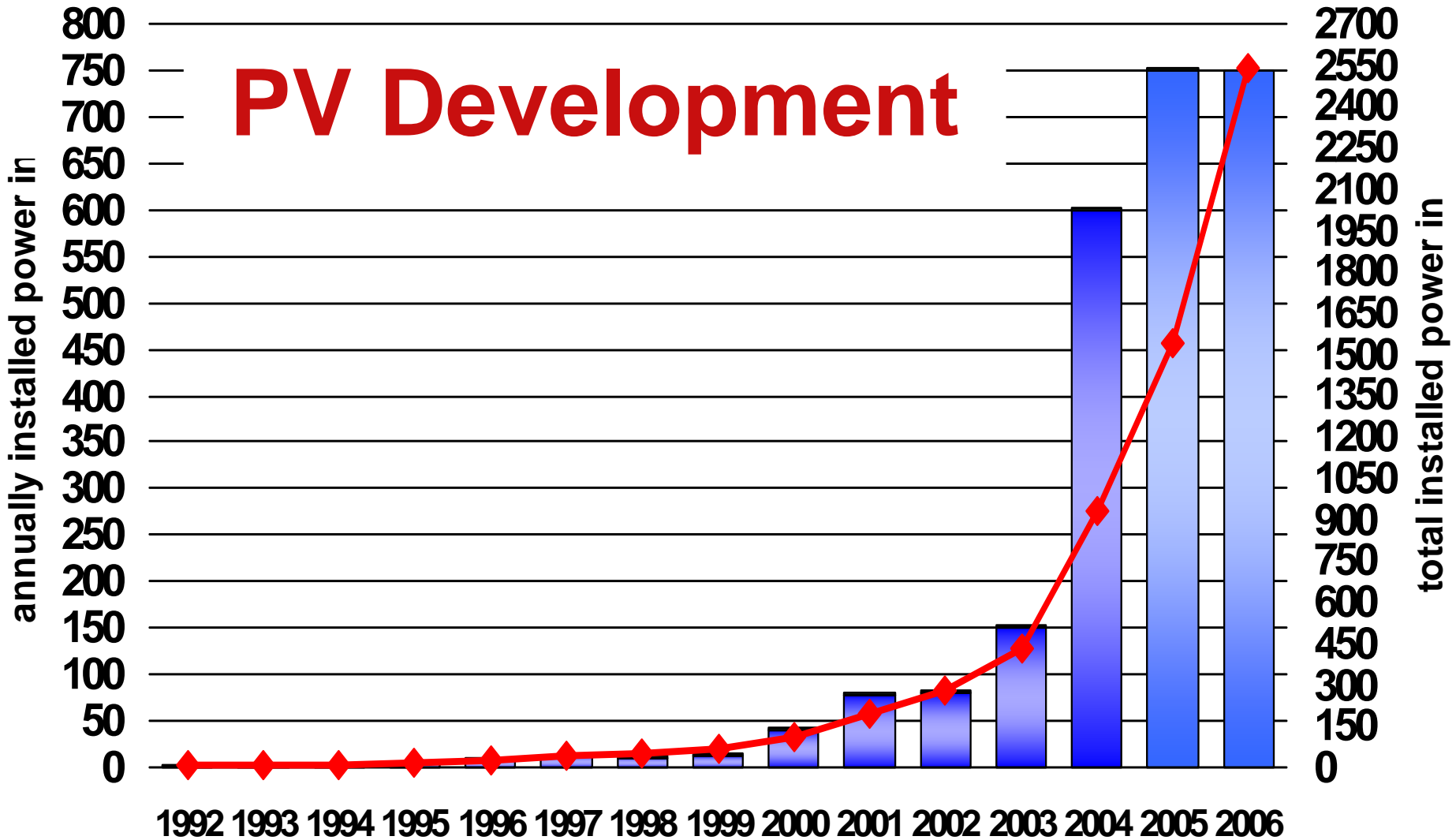


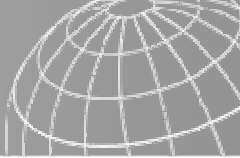
# German PV Market 2006

<b>Newly installed power</b>	<b>750 MWp (el)</b>
<b>Newly installed solar area</b>	<b>6 750 000 m<sup>2</sup></b>
<b>Total installed power</b>	<b>2 540 MWp (el)</b>
<b>Total installed solar area</b>	<b>22.8 Mio m<sup>2</sup></b>
<b>No. of newly installed systems</b>	<b>90 000</b>
<b>No. of total systems installed</b>	<b>300 000</b>
<b>Turnover 2006</b>	<b>3 800 Mio €</b>
<b>Employees</b>	<b>35 000</b>
<b>Market growth 2006</b>	<b>0%</b>

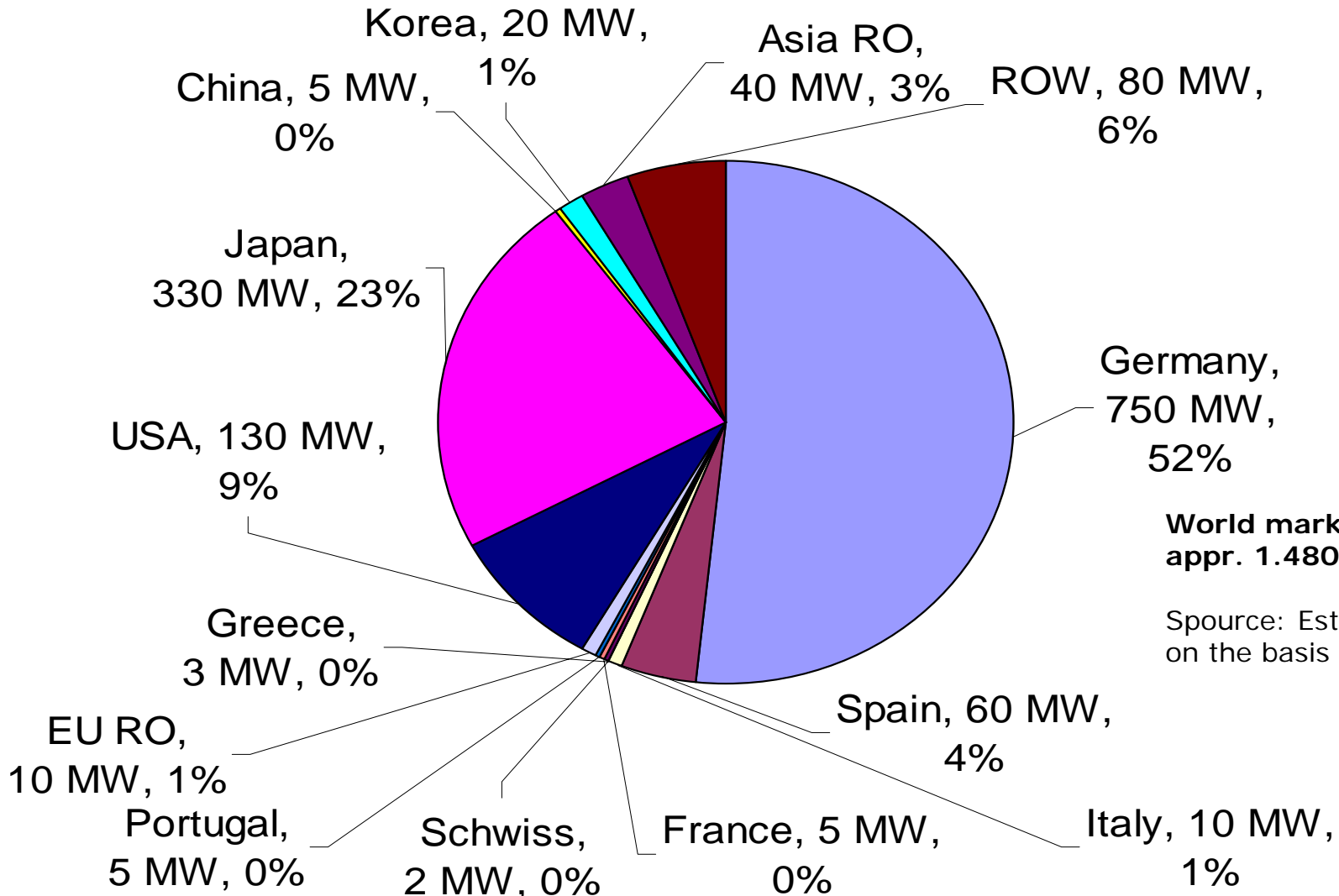


# PV Development



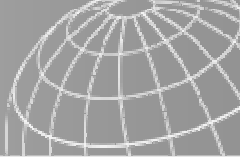


# Global PV - Market



World market 2006:  
appr. 1.480 MWp

Srouce: Estimation BSW  
on the basis of EPIA data



# History of the German PV Market

## 1991: Electricity Feed-In Act

- Right of (1) of grid access, (2) feed-in of solar electricity and (3) refund payment at fixed prices (approx. €ct8.5 [\$ct11] per kWh)

## 1991 - 1995: 1,000 Roofs Program

- Verification of PV systems' grid compatibility

## 1995 - 1999: Consolidation

- Only regional support programs, demo plants, development of the cost-covering refund payment system

## 1999 - 2003: 100,000 Roofs Program

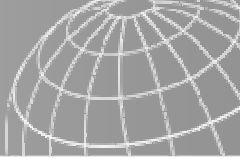
- Low-interest loans for 300 MWp of installed capacity

## 1/4/2000: Renewable Energy Sources Act (EEG)

- Solar electricity feed-in tariff of €ct51 [\$ct64] per kWh

## 1/1/2004: Amendment to EEG

- Feed-in tariff of €ct45.7–62.4 [\$ct57–78] per kWh

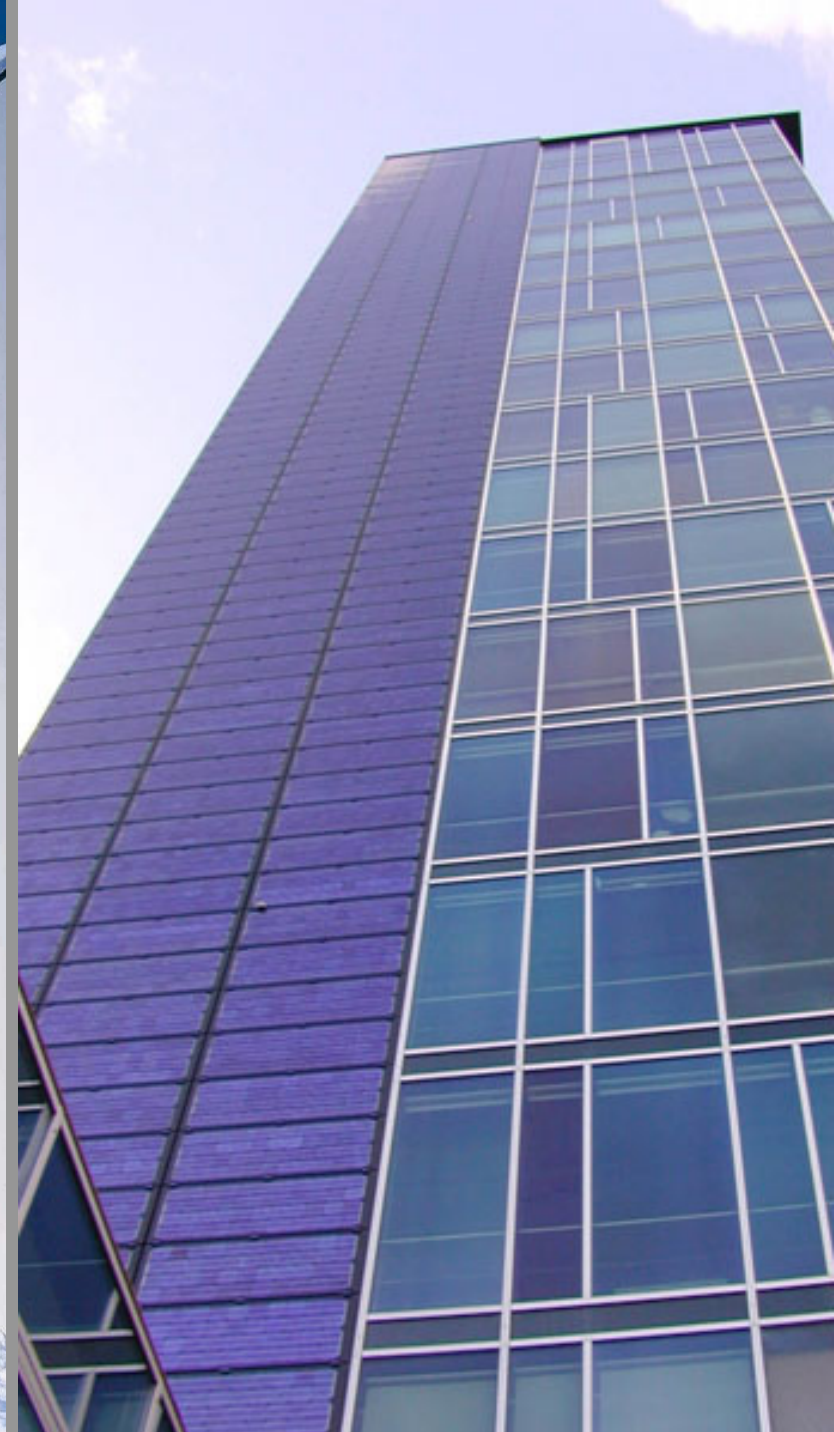


# EEG: Photovoltaic Feed-in Tariffs

Feed-in tariffs for PV systems installed in 2007, payed over 20 years

Feed-in tariff per kWh	up to 30 kWp	30–100 kWp	from 100 kWp
on buildings and noise protection walls	€ct 49.21	€ct 46.82	€ct 46.30
Façade-integrated	+ €ct 5		
Open land (ground-mounted)	€ct 37.96		

# Façade-integrated PV systems





# Large Roof-Mounted PV-Systems



Image: Solar-Fabrik



Image: BP

**400 kWp on the Freiburg Trade Fair Building**

**3.7 MWp on a factory building in Dingolfing**



**5 MW Ground-mounted System**

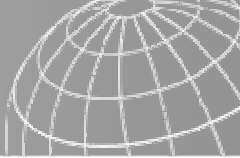
# 12 MW Double-Tracker System



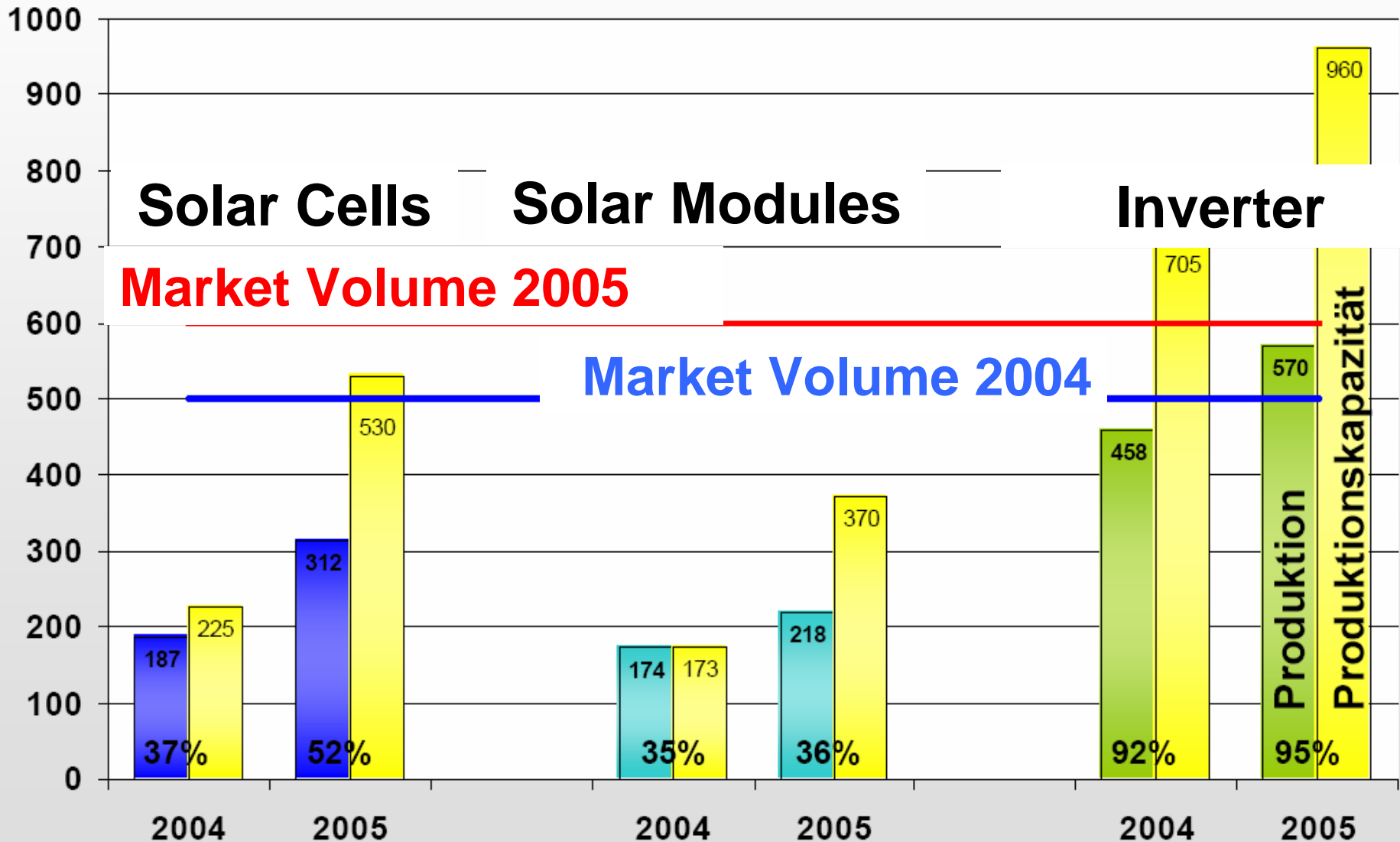


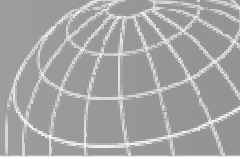
# PV Market and Industry Development

- > € 10 billion invested in PV systems
- > € 1 billion invested in manufacturing plants
  - About 40 silicon, wafers, cells, modules and inverters comp.
  - Modern and automated production lines
  - Strong technological development / increased R&D activities
- Strengthened photovoltaics market structures
  - 35,000 jobs have been created
- Drop in costs for PV systems
  - approx. 25% from 1999 to 2003
  - 60% from 1991 to 2003
- Increased export ability through increased production capacity



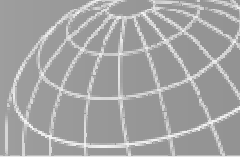
# Production Capacity & Output 2004-2005





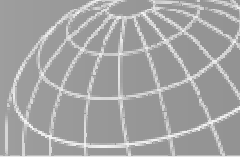
# 2010 – 2020 Outlook

- Annual Turnover: 2020 approx. 15,2 Bio. €
- By 2020 approx. 100.000 employees
- Value-Chain in Germany: 2020 approx. 75% today only 65%
- 1990-2020 overall cost reduction by 85%
- Intl. M&A will continue, in 2005 alone 25



# 2010 – 2020 Outlook

- Present annual investment so far approx. 1 Bio. €
- 2006/2007 Thin-Film Investment 500 Mio. €
- 2006, July 27 PV Electricity was cheaper than conventional electricity
- 20% share of global production capacity of solar cells
- 2010 approx. 4,5 GWe installed
- By 2010 Wacker Co. Ltd. will be No. 2 worldwide



# Outlook and Milestones

	<b>2007</b>	<b>2010</b>
Installed System Price	4,8 €/ Wp	3,6 €/ Wp
Production Cost	2,28 €/ Wp	1,60 €/ Wp
	<b>2007</b>	<b>2015</b>
Price Equality	0,35-0,55 €/ kWh	0,20-0,25 €/ kWh
Increased Cell Efficiency	Ø 15%	Ø 17,5%
Decreased Cell Weight	Ø 10 gr. / Wp	Ø 5 gr. / Wp
Cost for Inverters	0,40 €/ Wp	0,20 €/ Wp
Costs for Installation	0,25 €/ Wp	0,10 €/ Wp
Cost for Support Frame	0,20 €/ Wp	0,10 €/ Wp





# Conclusions

- The German PV market is growing very fast
- Driver of the German market is the feed-in tariff for solar electricity
- European Countries follow a similar market development approach as Germany
- German companies are heavily investing in new production facilities
- The limitation of PV modules is caused by limited Silicon availability, new Silicon production lines are under construction
- To date strong domestic market focus, but this will change in the near future



# Thank you for your attention !

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