The First International Scientific and Business Congress on Protecting the Climate – A World Joint Strategy – 22nd April 2008, City Hall Frankfurt am Main

Conditions for a successful global solar business

Gerhard Stryi-Hipp
Managing Director
German Solar Industry Association (BSW-solar)
Stralauer Platz 34, 10243 Berlin, Germany
Tel. +49 30 2977788 0, Fax +49 30 2977788 99
www.solarwirtschaft.de, stryi-hipp@bsw-solar.de

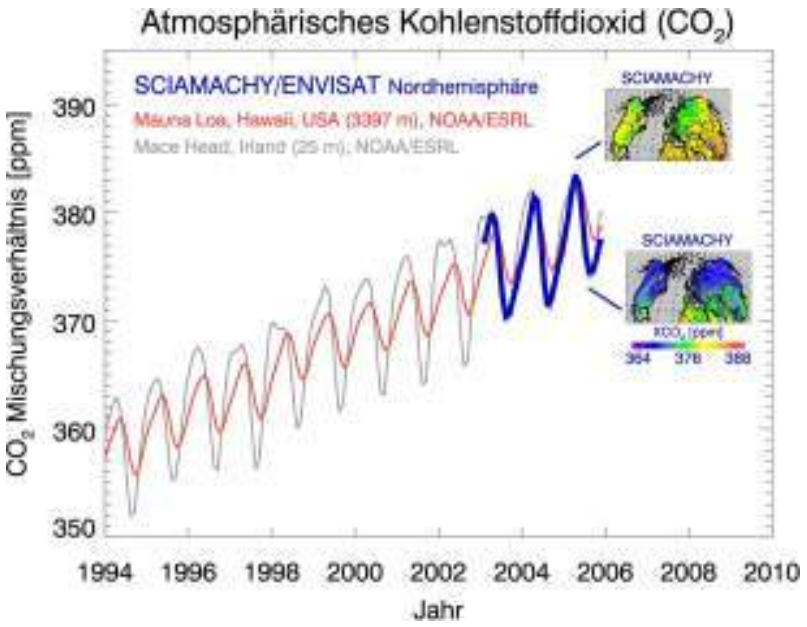
BSW - Bundesverband Solarwirtschaft
German Solar Industry Association

TASK	Representing German solar branch in the solar thermal energy and photovoltaics sectors
VISION	A worldwide sustainable energy supply using solar energy
ACTIVITIES	Lobbying, political advice, public relations, market observation, standardization
TIME	Over 25 years of activity in the solar energy sector
MEMBERS	More than 600 solar producers, suppliers, wholesalers, installers and other companies active in the solar field
HEADQUARTERS	Berlin

Strong growing problems of our fossil-nuclear energy supply system

- **Security of supply:**
  critical, due to strong growing energy import depencendy – especially from problematic regions
- **Finiteness of fossil and nuclear energy sources:**
  Growing demand and limited ressources lead to exploding energy prices
- **Climate change:**
  mainly caused by energy consumption is becoming reality as the UN-IPCC report has proven

„We should leave oil before it leaves us“
Fatih Birol, chief economist IEA, March 2008



CO_2-Concentration is growing continuously (IPCC 2007)

The future energy mix: Renewable Energies

Only Renewable Energies are

- everlasting
- „domestic“ energy sources
- sustainable and not harming the climate
- becoming cheaper and cheaper
- increasing the domestic and regional added value
- creating jobs




Quelle: Aus BMU, Daten EE, Juni 2007

The challenges are

- **organizing and financing of investments in RES** as long as RES are more expensive than fossil and nuclear energy
- **the reconstruction of the energy supply system** to a decentralized intelligent system based on RES

Quelle: Solarwatt

Quelle: Wagner & Co

Photovoltaics – Why should it be used?

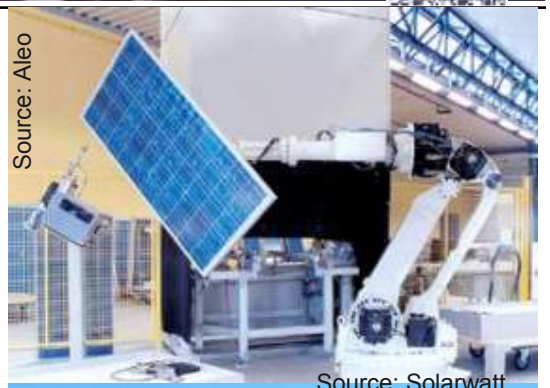
PV is the most fascinating way to produce electricity

Advantages

- PV can be used **everywhere** worldwide
- PV can be used **grid connected** and **off-grid**
- PV can be used in **every size**
- PV needs only **one initial investment**
- PV **does not harm** the environment
- **PV has the biggest potential under all RES**

Challenge: PV today is **often the most expensive** way to produce electricity with RES, but has the **highest cost reduction potential**

=> PV has to be developed today in order to have
(1) enough solar capacity available in one decade
(2) at a competitive price



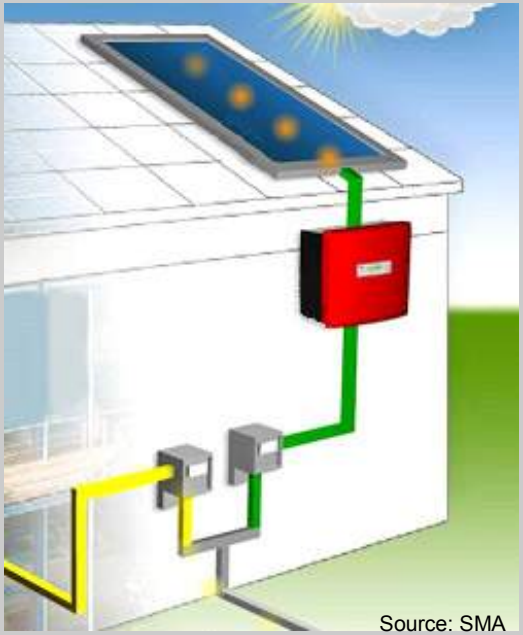

Source: Solarwatt


Source: Phönix


Source: SMA

Photovoltaics – electricity production everywhere

Grid Connected Systems
Solar electricity is fed into the public grid
=> wherever a grid is available


Source: SMA

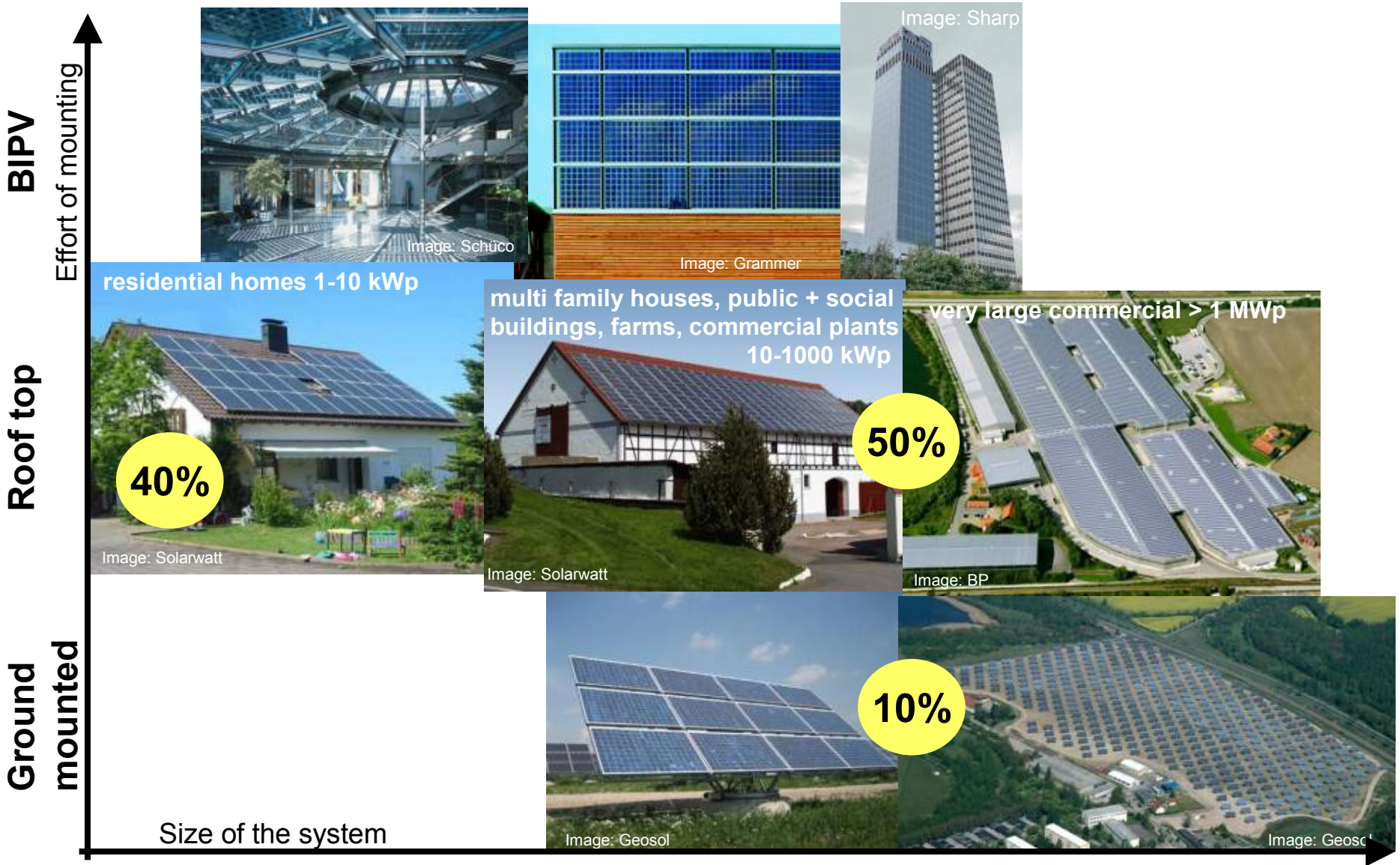
Micro Grid Systems
Supply of a few homes up to villages, solar or hybrid systems possible
=> full electricity supply for rural areas


Source: SMA

Solar Home Systems
Supply of single buildings to cover basic needs: light, communication, TV
=> basic needs for single buildings


Source: Phocos

Market segments of on-grid PV Systems in Germany



Development of the German PV-market

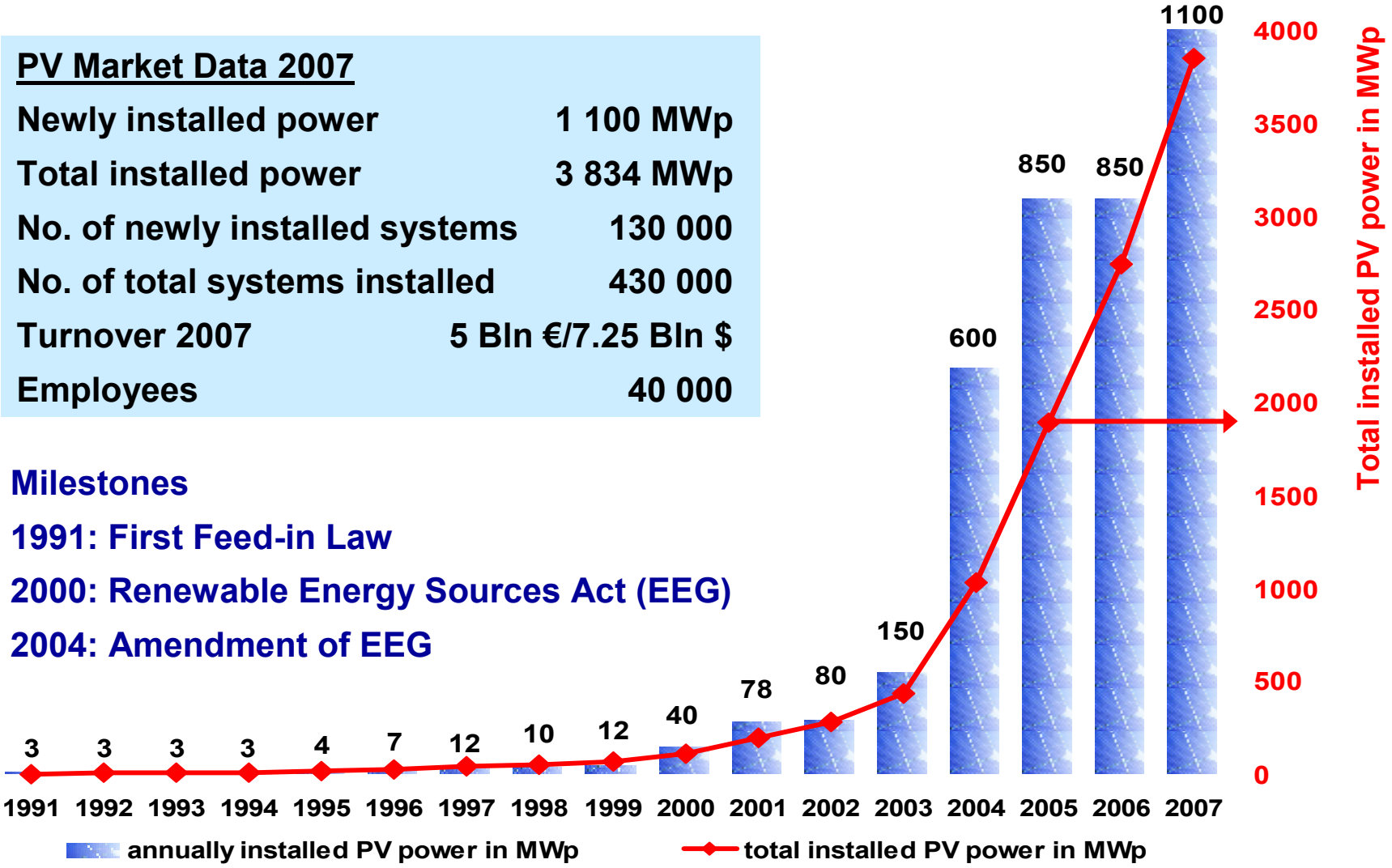
PV Market Data 2007	
Newly installed power	1 100 MWp
Total installed power	3 834 MWp
No. of newly installed systems	130 000
No. of total systems installed	430 000
Turnover 2007	5 Bln €/7.25 Bln $
Employees	40 000

Milestones

1991: First Feed-in Law

2000: Renewable Energy Sources Act (EEG)

2004: Amendment of EEG



How does the German feed-in law (EEG) work

Principles

- Every PV system **has to be connected** to the grid
- Every solar kWh **has to be bought** by the utility
- **Fixed feed-in tariff over 20 years**
- **Reduction of the feed-in tariff every year by 5%** for newly installed PV systems

2.22 TWh solar electricity sold for mio€ 1,176 [mio$ 1,700] (average €53ct per kWh)

Share of solar electricity: 0.45%

Fossil and nuclear electricity

(and other renewables)

Utilities grid

Consumption of 495 TWh

Price private consumer: appr. €20ct per kWh Including €0.24ct for PV

consumer

Price increase for consumer: 1.2%

Data of 2006

Photovoltaic market deployment strategy

Phase 1 until 2020:

- Build up PV markets and capacities
- Reduce PV costs

=> The number of markets, where PV is cost competitive is growing steadily

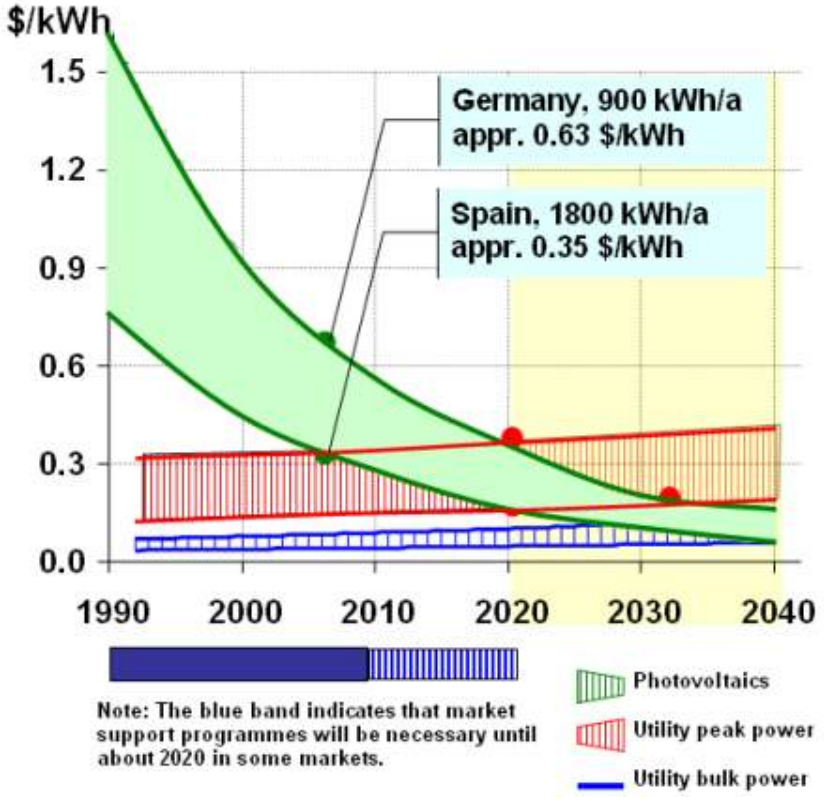
=> Support instruments are necessary

Phase 2 beyond 2020:

- Fast increase of the use of PV
- PV becomes a crucial pillar of electricity production

PV competitiveness

cost development in different regions and electricity rate development



Feed-in tariffs in Germany

are calculated in a way, that investments in PV systems are profitable. PV systems installed in 2008 receive following tariffs over 20 years:

Feed-in tariff per kWh	< 30 kWp	30–100 kWp	> 100 kWp
on buildings and noise protection walls	**€ct 46.75** $ct 67.8	**€ct 44.48** $ct 64.5	**€ct 43.99** $ct 63.8
Façade-integrated	**additional €ct 5** $ct 7.25		
Open land (ground-mounted)	**€ct 35.49** $ct 51.5		

Image: Solar-Fabrik

Image: Degussa

Small and Medium Roof-top Installations

Large Roof-top PV-Systems

400 kWp on the Freiburg Trade Fair Building

3.7 MWp on a factory building in Dingolfing

Examples of ground mounted PV systems


Image:Geosol


Image:Phönix


Image: Geosol


Image: Epuronl

Successful market entrance strategy in Germany

- **More than €15 billion were invested in PV systems since 2000**
- **More than €3 billion were invested in manufacturing plants since 2000**
- **Drop in costs** for PV systems of
  - approx. 25% from 1999 to 2003
  - approx. 5% annually since mid 2006

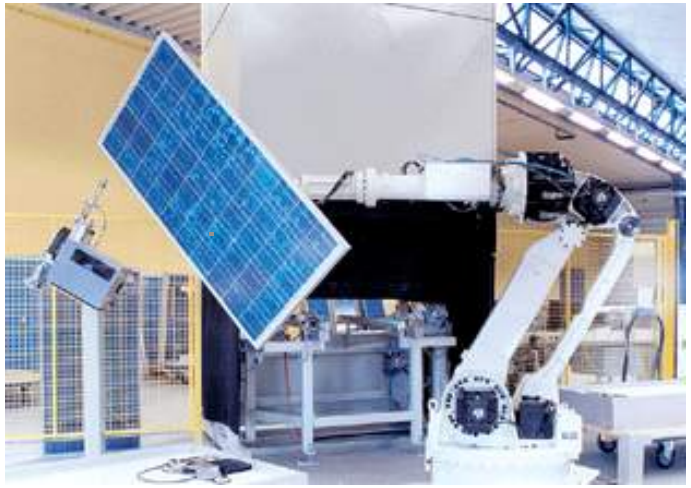


Image: Aleo

Create PV demand by:
- Granting the right of solar electricity production and grid connection
- Making solar electricity production financially attractive

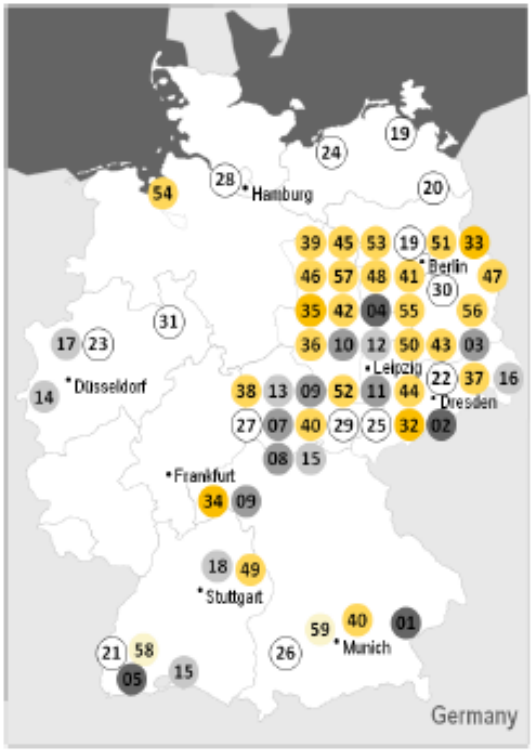
Building up:
- PV market
- PV production
- Installation capacities

Reduction of costs
Less energy imports
Creation of jobs

PV will become:
- Cost-competitive
- An important pillar of the sustainable energy system

Production follows the market: PV Producer in Germany

Value chain	No.	Company	Location	Capacity 2008 [MWp]	Current Empl.
Silicon	1	Wacker Chemie	Burghausen	10,000t	960
	2	Scheuten Solar World Solizium	Freiberg[1]	1000t	n/a
	3	Sunways	Spreewitz[1]	1000t	n/a
	4	PV Silicon	Bitterfeld-Wolfen[1]	900t	15
	5	Joint Solar Silicon	Rheinfelden[1]	850t	n/a
	6	City Solar	Bitterfeld-Wolfen[1]	n/a	25
Wafers	7	PV Silicon[2]	Erfurt	290	140
	8	ASi Industries[3]	Arnstadt	180	220
	9	Wacker Schott Solar	Alzenau, Jena[1]	160	120
	10	Q-Cells	Thalheim[1]	80	10
	11	WPI Wafer Production Int.[2]	Leipzig	n/a	n/a
Cells	12	Q-Cells	Thalheim	875	1460
	13	Ersol Solar Energy	Erfurt, Arnstadt	220	350
	14	Solland Solar Cells	Aachen	170	200
	15	Sunways	Konstanz, Arnstadt	115	130
	16	Arise Technologies	Bischofswerda	35	10
	17	Scheuten Solar Cells	Gelsenkirchen	35	80
	18	Solarwatt	Heilbronn	25	60
Modules	19	Solon	Berlin, Greifswald	260	400
	20	Aleo Solar	Prenzlau	170	425
	21	Solar-Fabrik	Freiburg	130	270
	22	Solarwatt	Dresden	110	350
	23	Scheuten Solar Technology	Gelsenkirchen	90	140
	24	Solara Sonnenstromfabrik	Wismar	80	130
	25	Heckert Solar	Chemnitz	60	80
	26	Webasto Solar	Landsberg/Lech	35	20
	27	Asola	Erfurt	30	80
	28	Solamova	Wedel	10	30
	29	GSS	Löbichau	10	30
	30	PVflex Solar	Fürstenwalde	5	30
	31	Schüco Solar	Bielefeld	5	n/a

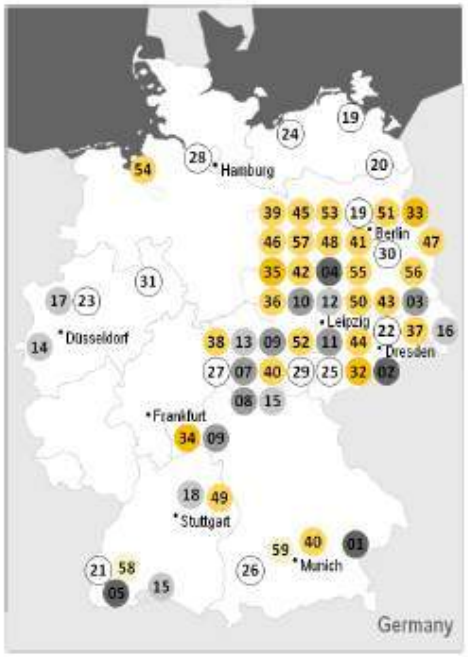


1) Planned/under construction
2) Excluding ingots
3) Subsidiary of Ersol
4) Subsidiary of Q-Cells
5) Subsidiaries of Solarworld:
Deutsche Solar, Deutsche Cell, Solar Factory
6) Wafer production by Wacker Schott Solar No.9
Source: ***Invest in Germany***, March 2008

Source: Invest in Germany, March 2008

Production follows the market: PV Producer in Germany

Fully Integrated	32	Solarworld[5]	Freiberg	450/300/250	900
(Wafers/Cells/ Modules)	33	Conergy	Frankfurt (Oder)	300/275/250	370
	34	Schott Solar	Alzenau	160/275/200	1000
	35	EverQ	Thalheim	100/100/100	450
Thin Film					
Poly-Si	36	CSG Solar	Thalheim	20	140
a-Si a-Si/µc-Si	37	Sunfilm	Großröhrsdorf[1]	60	10
	38	Ersol Thin Film	Erfurt	40	130
	39	Malibu	Osterweddingen[1]	40	n/a
	40	Schott Solar	Jena, Putzbrunn[1]	30	160
	41	Inventux	Berlin[1]	30	n/a
	42	Brilliant 234.[4]	Thalheim	25	60
	43	EPV	Senftenberg[1]	25	n/a
	44	Signet Solar	Mochau[1]	20	10
CIS CIGS CIGSSe	45	Johanna Solar Technology	Brandenburg	30	100
	46	Solibro[4]	Thalheim[1]	30	20
	47	Odersun	Frankfurt (Oder), Fürstenwalde[1]	30	80
	48	Global Solar Energy	Berlin[1]	30	n/a
	49	Würth Solar	Schwäbisch Hall	30	220
	50	Avancis	Torgau[1]	20	60
	51	PVflex Solar	Fürstenwalde	10	30
	52	Solarion	Leipzig	10	20
	53	Sulfurcell	Berlin	5	60
	54	CIS-Solartechnik	Bremerhaven	Pilot	20
	55	Nanosolar	Luckenwalde[1]	n/a	50
CdTe	56	First Solar	Frankfurt (Oder)	160	500
	57	Calyxo[4]	Thalheim	25	40
CPV	58	Concentrix Solar	Freiburg	10	40
	59	SolarTec	Munich	10	50



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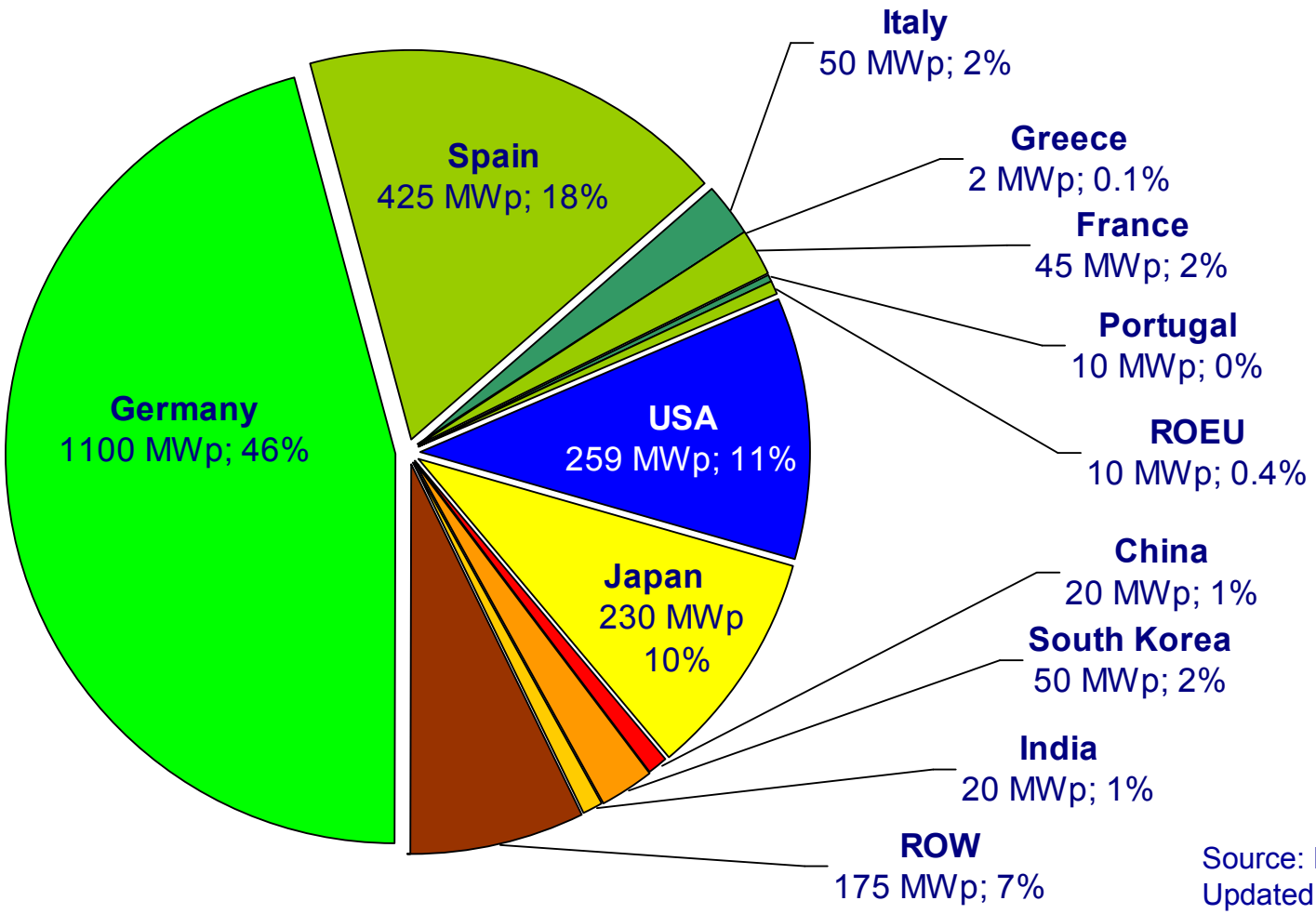
Source: *Invest in Germany*, March 2008

Source: Invest in Germany, March 2008

Photovoltaic World Market

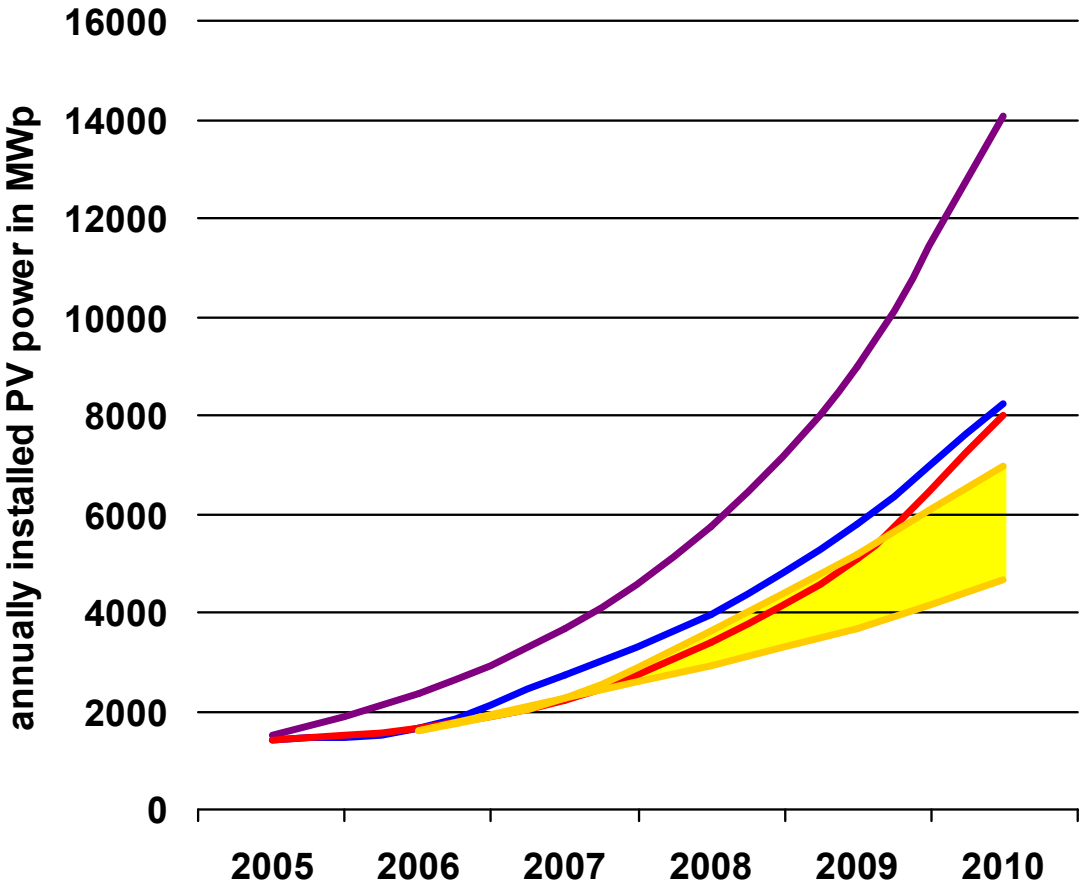
New installed PV Power in 2007: 2.4 GWp



Source: EPIA, ASIF, BSW
Updated February 2008

Perspectives of the PV World Market Development

Huge differences in different studies, but one direction: strong growth



The supply of silicon and therefore PV-modules will in the coming years grow faster than the demand.
BSW-Solar agrees on the expectation of EPIA of a PV world market between 4.7 and 7 GWp in 2010.

- **Photon Consult 2006**
- **Sarasin 2007**
- **LBBW 2007**
- **EPIA 2007 max**
- **EPIA 2007 min**

Solar thermal – heating from the sun

Worldwide, a huge share of fuel is used to heat water which can easily be replaced by solar thermal systems

Multitude of possible applications

- Domestic hot water heating
- Space heating support
- Solar assisted air conditioning and cooling
- Industrial process heat applications
- Sea water desalination

Advantages of solar thermal energy

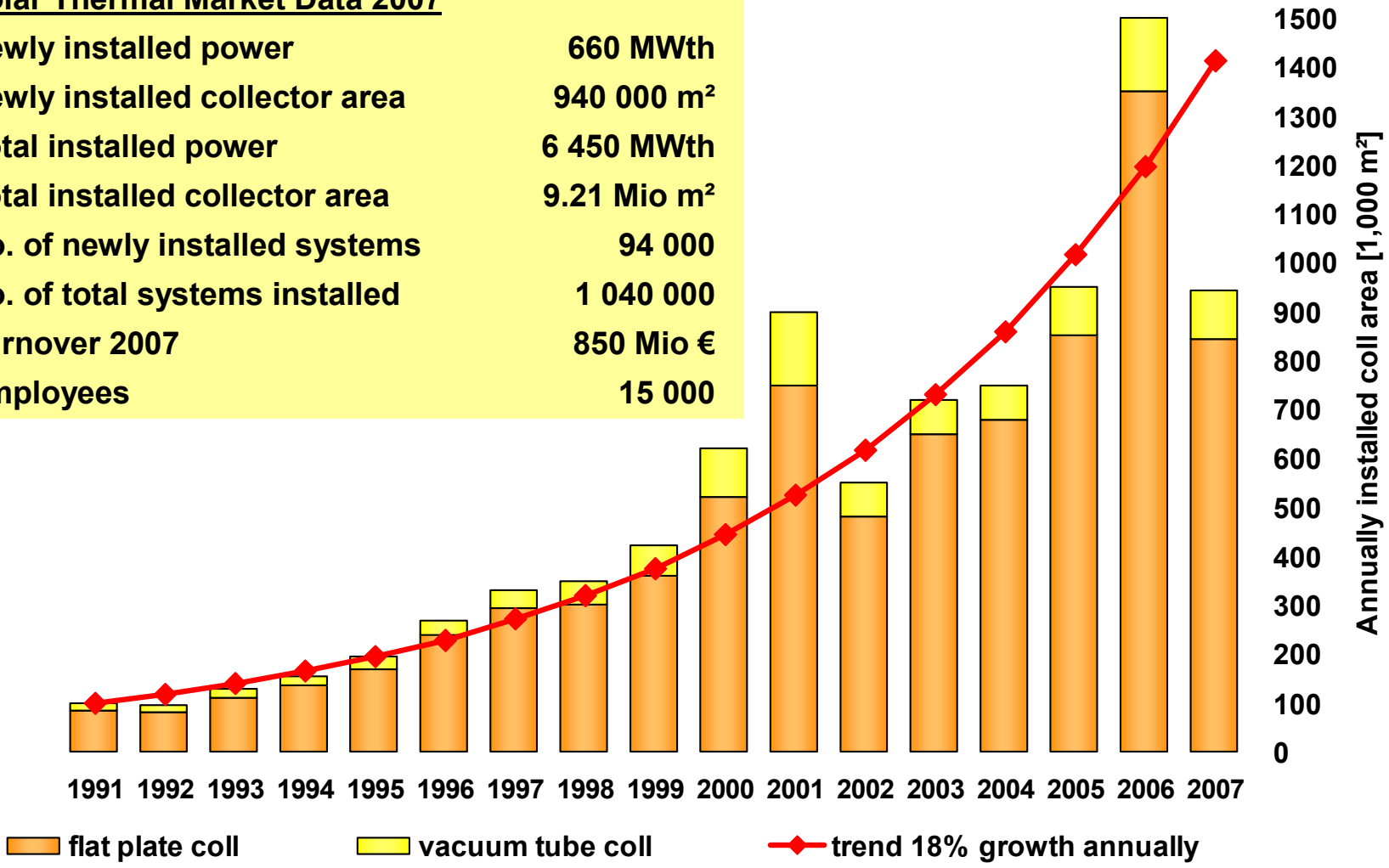
- Reduction of GHG emissions by efficient replacement of oil, gas and electricity
- Adapted technologies are available for all regions and climates of the world
- Increased user comfort

Source: Schüco

Source: Solahart / ESTIF

Solar Thermal Market Development in Germany

Solar Thermal Market Data 2007	
Newly installed power	660 MWth
Newly installed collector area	940 000 m²
Total installed power	6 450 MWth
Total installed collector area	9.21 Mio m²
No. of newly installed systems	94 000
No. of total systems installed	1 040 000
Turnover 2007	850 Mio €
Employees	15 000



Conclusions

- **Solar energy will become the most important pillar** in the future RES energy mix
- **PV market and industry development has started already** in order to reduce costs and build up capacities
- **Solar energy** should be part of a sustainable energy and climate policy **in every country**
- The development of solar markets **needs support mechanisms**

Conditions for a successful global solar business

- **Clear goals** for solar & establishment of a **solar long term strategy**
- **Development of national solar markets immediately**
- **Establishment of effective support mechanisms**
- **Usage of the experience of existing markets**


Source: Phaesun


Source: Frankensolar


Source: Schott Solar


„Solar architecture is not about fashion,
it is about survival“ (Sir Norman Foster)
Thank you very much for your attention!
Image: Suntechnics, Sunways