International Renewables Policies with focus on Europe and Germany

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The foundation of IRENA: big success for the renewables

- International Renewable Energy Agency (IRENA): a dedicated International Organisation for renewables
- Founded in Bonn on January 26, 2009
- 76 countries signed
- India: Cabinet decided to sign soon
- An unexpected success
- An important signal, far beyond the organisation itself: Renewables are being taken serious

Founding IRENA within less than a year: using a window of opportunity

- More than 20 years of discussion
- A determined government pushing the process: Germany, supported by Spain and Denmark
- Need to close before German elections and before the Copenhagen climate conference
- An unexpected strong support at the end:
  - The exacerbation of the financial crisis showing the vulnerability of our economies
  - The election of Obama and the expected U-turn in US climate and energy policies
  - The natural gas crisis in Europe
  - When IRENA really comes, nobody wants to stay aside

The challenge: to transform the energy system within 20 years

- We really need to transform the energy system
  - Climate change
  - Depleting fossil and nuclear fuels
  - Energy security
- We can do it
  - Renewables can cover large part of energy needs by 2050 if decisions are being taken soon
  - Technology is ready, some markets are taking off
- It is not easy, we need to learn how
  - Organising a steady and strong global growth of renewables requires new policies and new cooperation
  - Established structures and interest groups tend to avoid change
- Emerging economies can play a key role

Changing priorities in the economic crisis?

- For many economies the hardest crisis since decades
- No signs for steps backward by governments : renewables are seen as part of the solution
- Dependence on oil one cause of imbalances
- General reaction: rethinking an unsustainable lifestyle
- Nevertheless clouds for the sector:
  - low oil price
  - credit crunch
  - postponed investments
- How will all this affect business?

Good signs for renewables

- EU sets ambitious targets for renewables and decides robust policies
- Obama promises a U-turn in US policies
- Unstoppable innovation: renewables becoming competitive earlier than expected
- More countries joining the frontrunners

EU sets ambitious targets for 2020

- In December 2008 the EU decided compulsory targets for 2020
  - Decrease of CO2 emissions: -20%
  - Reduction of energy consumption: -20%
  - Share of renewables in final energy 20% consumption
- National targets agreed, national action plans required
- Detailed policies for electricity, heat
- >10% biofuels, sustainability criteria required

EU Country Targets for 2020

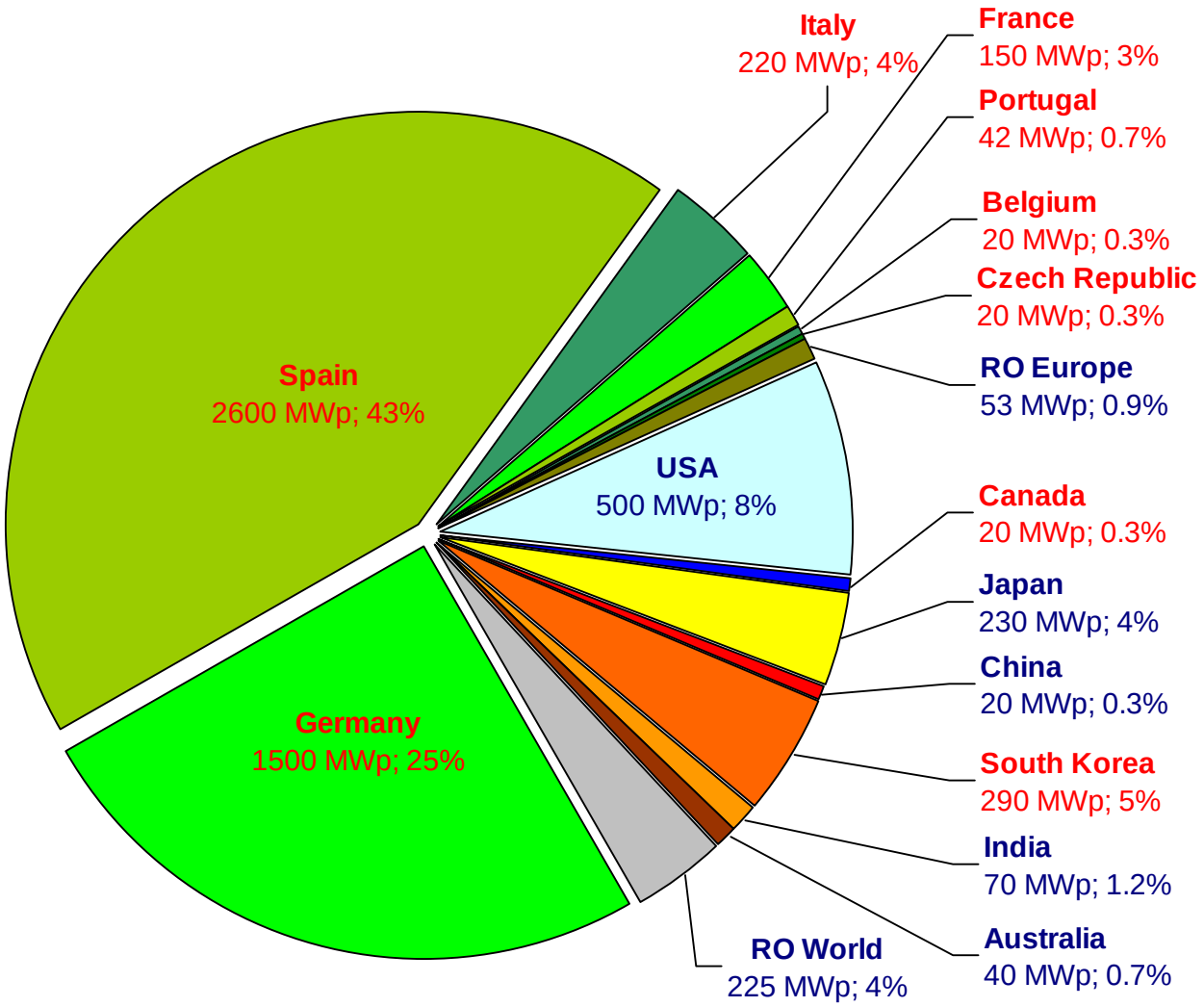
Share of energy from renewable sources in final consumption

	2005	Target for 2020
European Union		
Denmark	17.0%	30%
Germany	5.8%	18%
Greece	6.9%	18%
Spain	8.7%	20%
France	10.3%	23%
Italy	5.2%	17%
Malta	0.0%	10%
Austria	23.3%	34%
Portugal	20.5%	31%
Sweden	39.8%	49%
United Kingdom	1.3%	15%

US: Obama promises policy U-turn

- Cooperation in international climate policies
- Consistent measures for renewable energy in the crisis package
- Sees importance of employment aspect
- Committed people in top positions of the new administration
- Immediate target: Double role of renewables within three years, 4800km new power lines
- New policy instruments discussed

Photovoltaic World Market 2008



New installed PV Power

2006: 1600 MWp

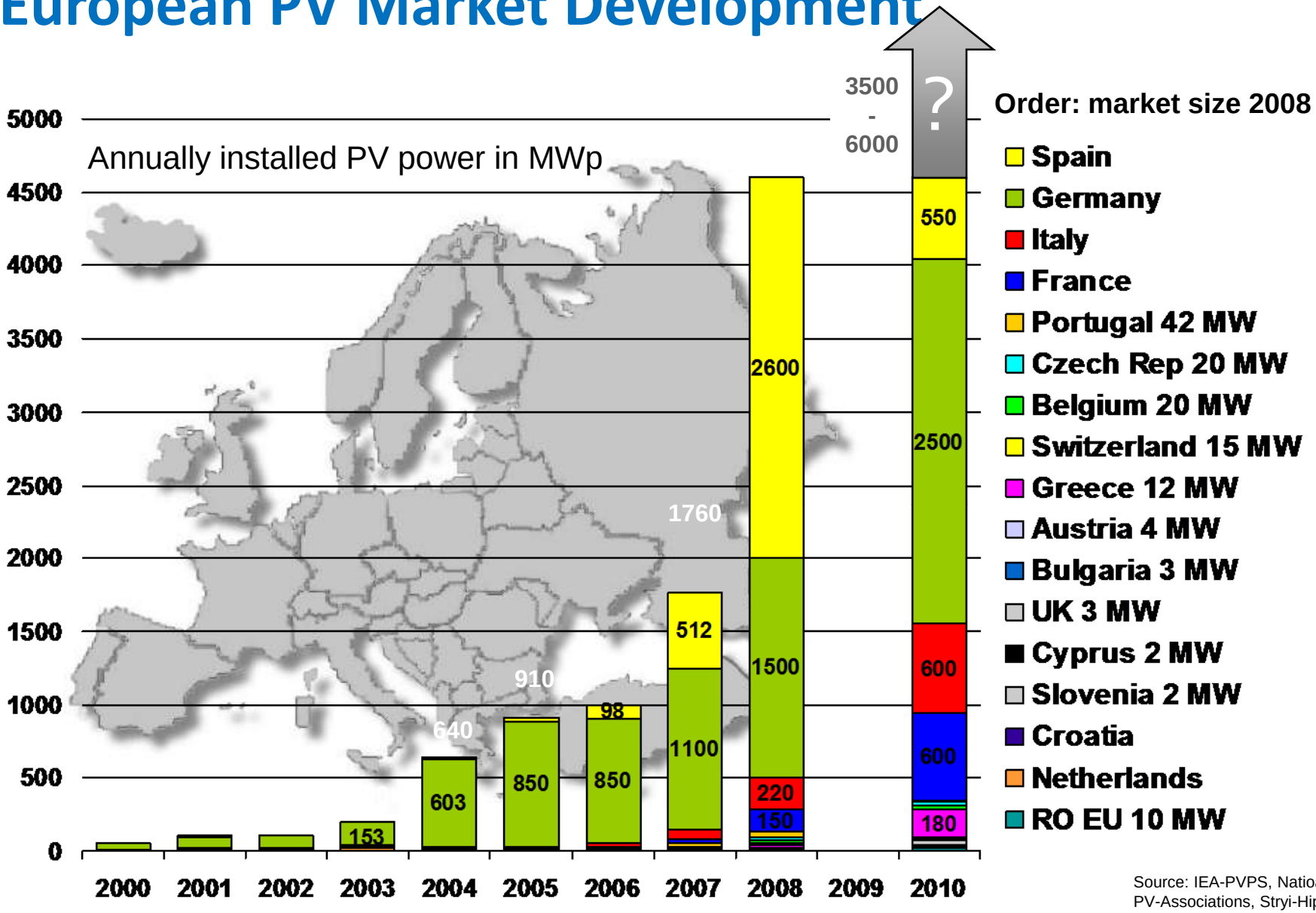
2007: 2650 MWp (+66%)

2008: 6000 MWp (+126%)

Red Letters: Countries with Feed-in tariff schemes

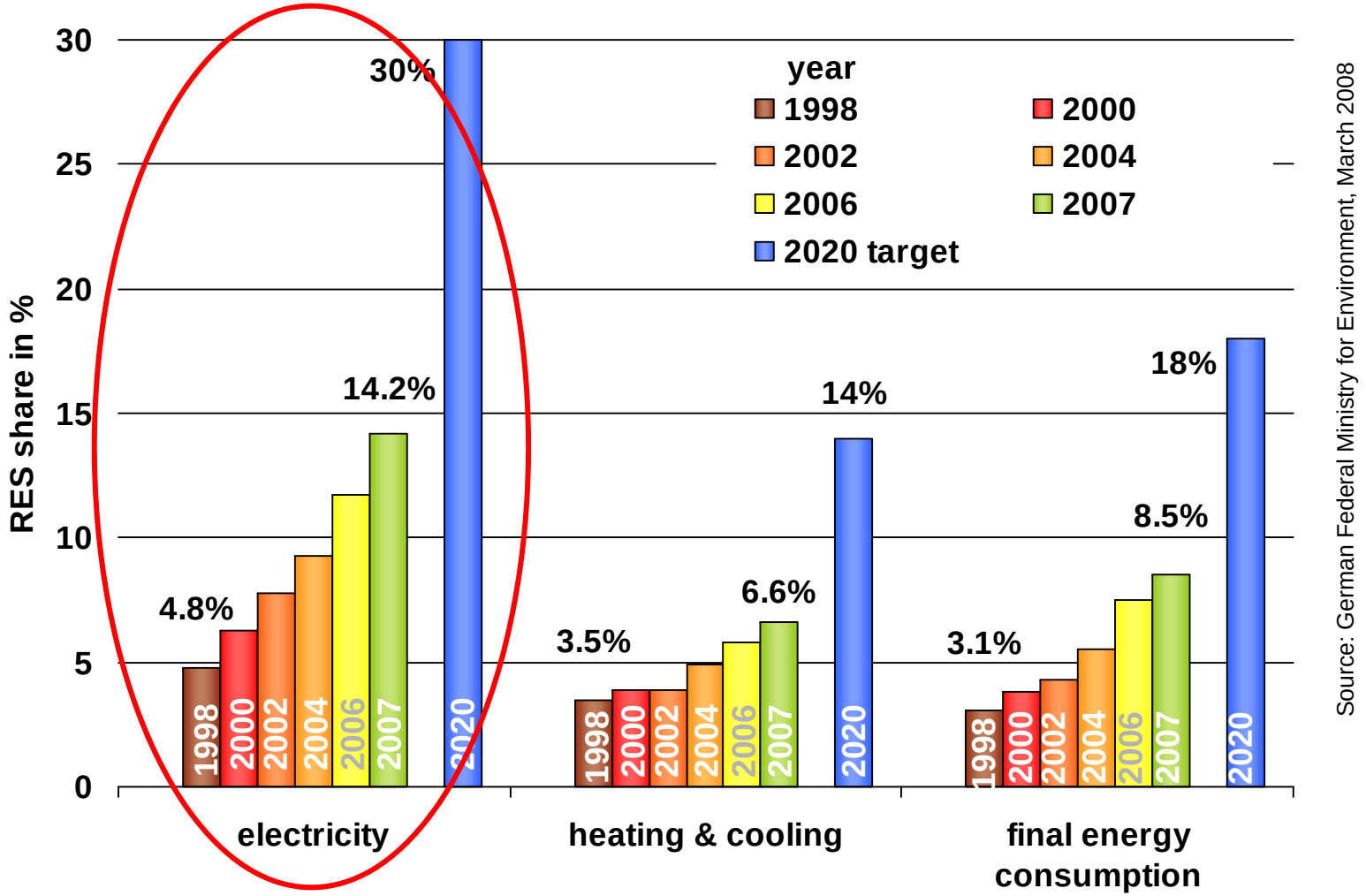
Source: Preliminary figures of National PV Associations, Stryi-Hipp, Feb 26th 2009

European PV Market Development



Source: IEA-PVPS, Natioal PV-Associations, Stryi-Hipp

Development of the renewable share in final energy consumption

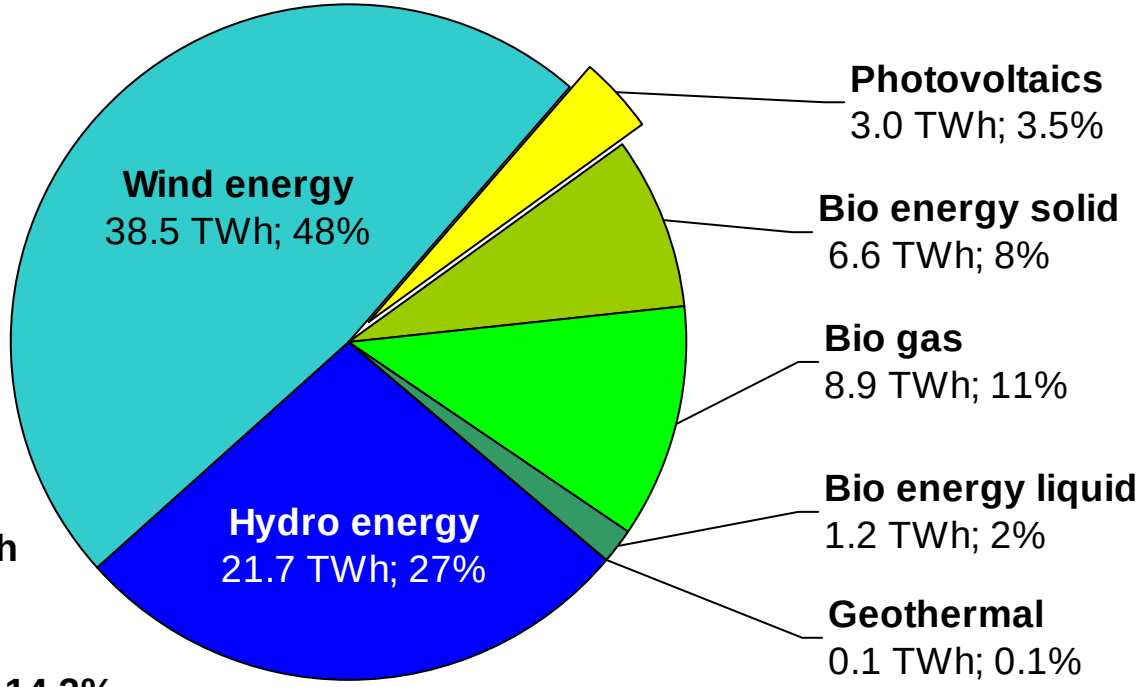


Source: German Federal Ministry for Environment, March 2008

Share of Solar Electricity in Germany

Share of PV solar electricity
- of overall electricity consumption 2007: 0.72%
- of renewable energy electricity 2007: 3.5%

Distribution of Renewable Energy Electricity Production in Germany 2007



Total RES electricity production 2007: 86.7 TWh
RES share of electricity consumption: 14.3%

Source: BEE, Jan 2008

Development of the German PV market

PV Market Data 2008	
Newly installed power	1 500 MWp
Total installed power	5 334 MWp
No. of total systems installed	ca. 500 000
Turnover 2008	6 Bln € / 8.1 Bln $
Employees	45 000

Milestones

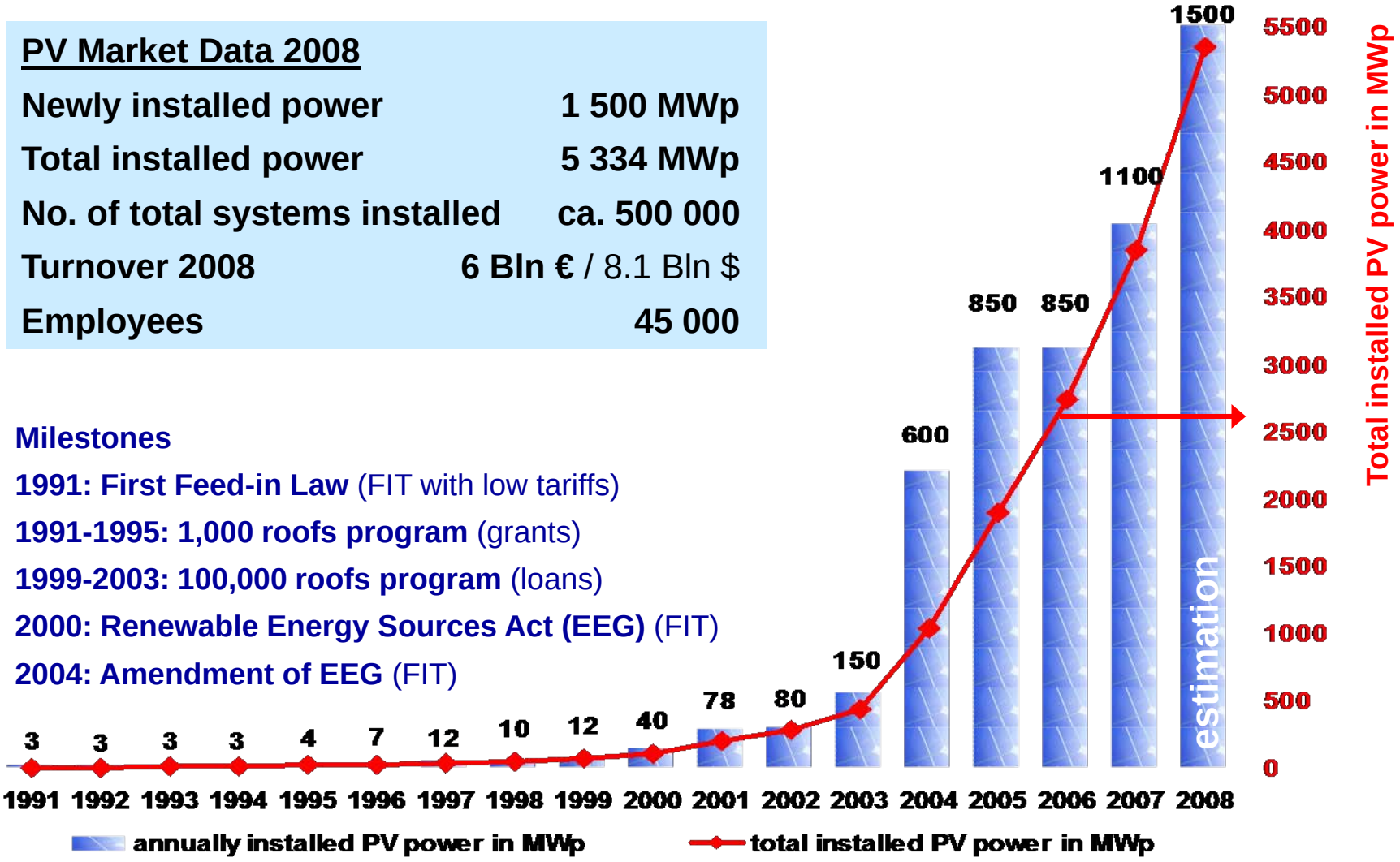
1991: First Feed-in Law (FIT with low tariffs)

1991-1995: 1,000 roofs program (grants)

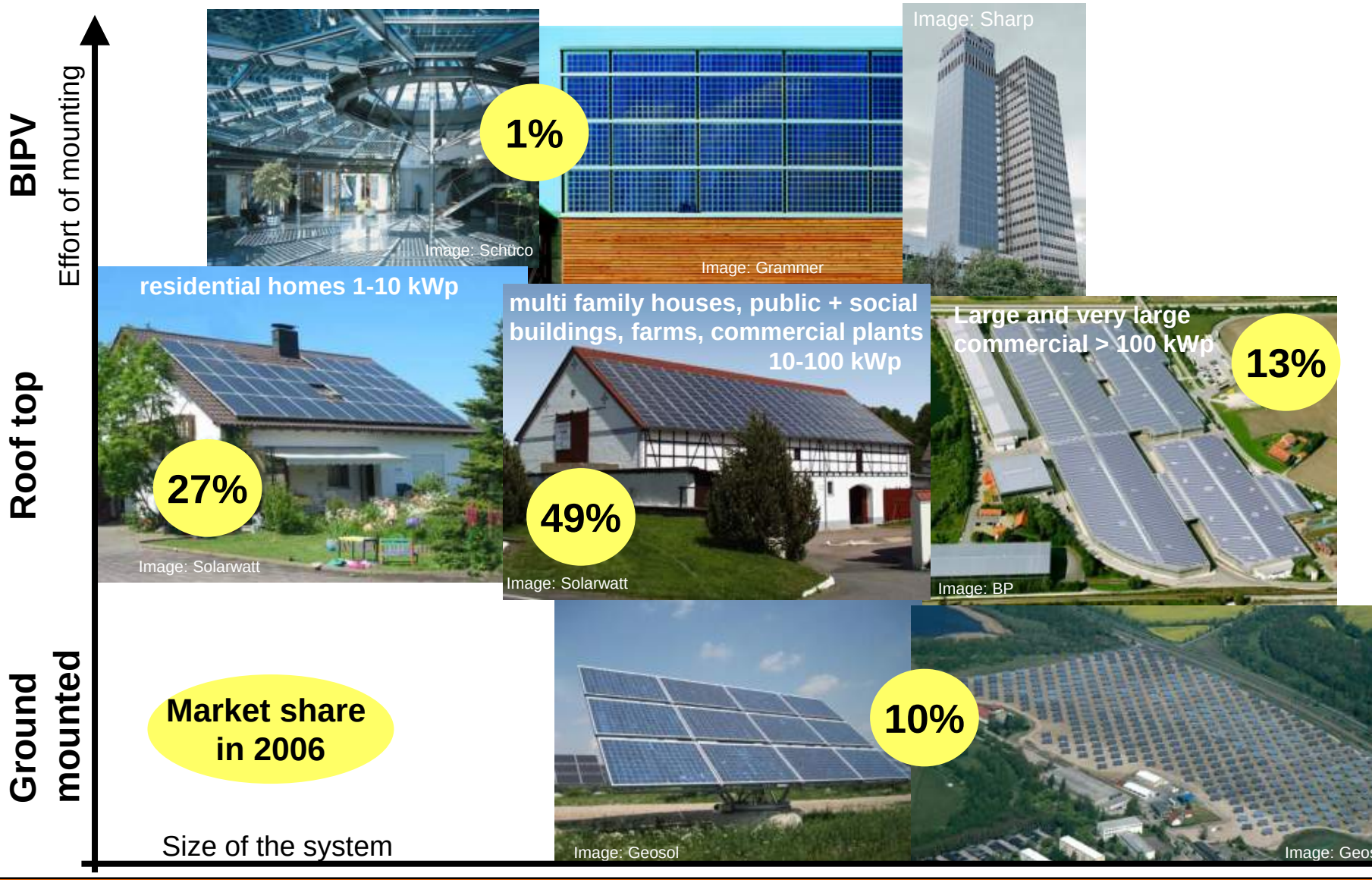
1999-2003: 100,000 roofs program (loans)

2000: Renewable Energy Sources Act (EEG) (FIT)

2004: Amendment of EEG (FIT)

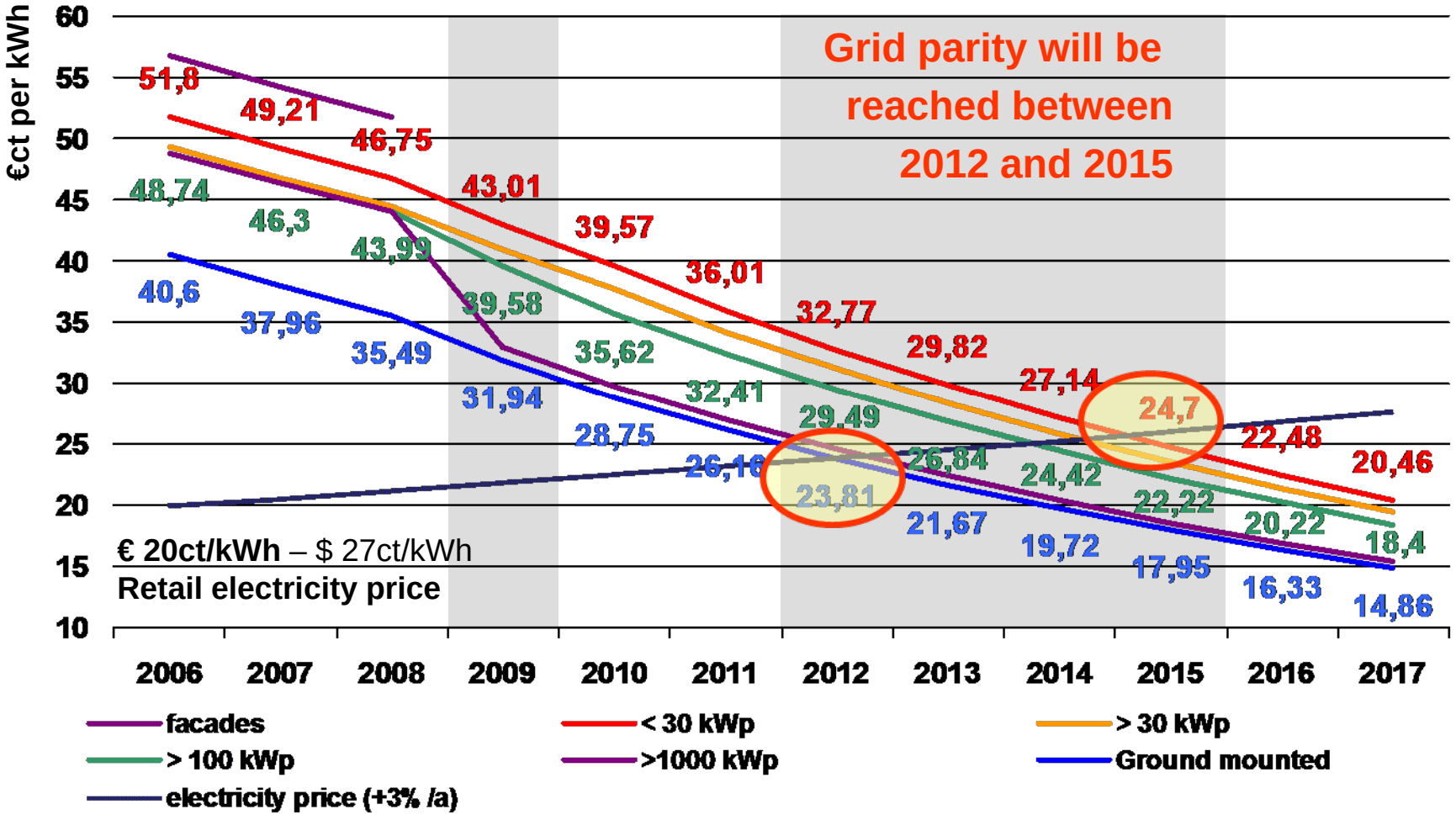


Germany: Market Segments of on-grid PV Systems



Development of feed-in tariffs for PV within the German EEG

With increased degression rates as of 2009



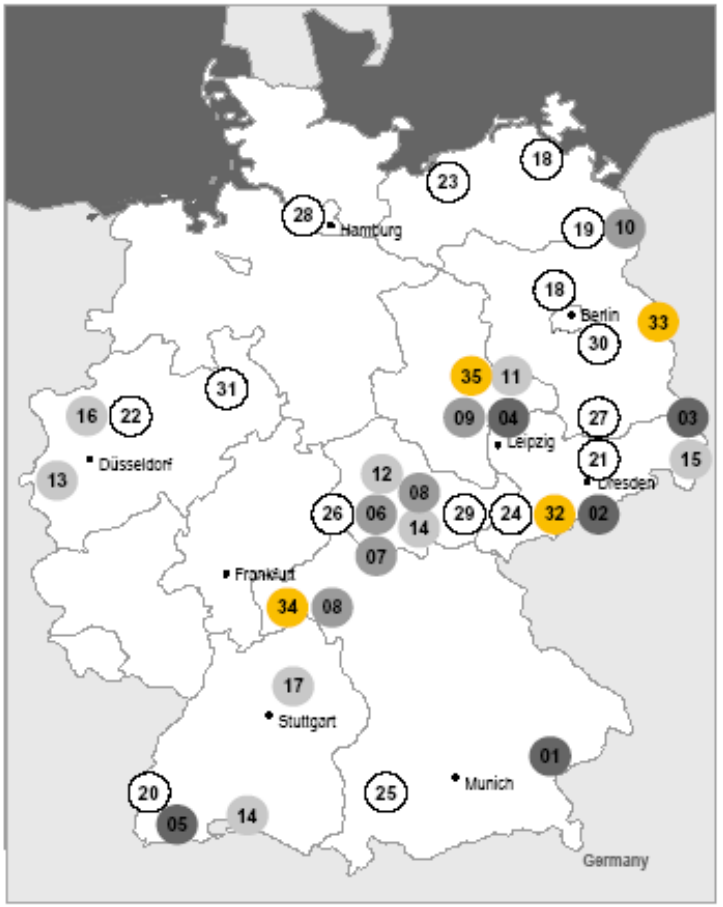
Germany: Good results of a an early dedicated, long-term support policy

- Development of a broad market with many competent participants
- Setting up of an industrial-scale production leading to substantial cost reductions (international)
- Triggering multiple innovations (international)
- Creating employment at all steps of the value chain
- Creating a broad support for structural change (national)
- Building up a strong own industry in the sector (national)
- Achieving a take-off of the markets (international)

German PV cluster: production wafer-based

Value Chain	No.	Company	Location	2008 [MWp]	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	20
	5	Joint Solar Silicon	Rheinfelden[1]	850t	10
Wafers	6	PV Silicon[2]	Erfurt	290	160
	7	ASi Industries[3]	Arnstadt	180	480
	8	Wacker Schott Solar	Alzenau, Jena[1]	120	300
	9	Q-Cells	Thalheim[1]	80	10
	10	Mola Solaire	Pasewalk[1]	n/a	n/a
Cells	11	Q-Cells	Thalheim	760	1900
	12	Ersol Solar Energy	Erfurt, Arnstadt	220	300
	13	Solland Solar Cells	Aachen	170	300
	14	Sunways	Konstanz, Arnstadt	120	290
	15	Arise Technologies	Bischofswerda	35	10
	16	Scheuten Solar Cells	Gelsenkirchen	35	80
	17	Solarwatt	Heilbronn	15	60
Modules	18	Solon	Berlin, Greifswald	260	400
	19	Aleo Solar	Prenzlau	170	425
	20	Solar-Fabrik	Freiburg	130	290
	21	Solarwatt	Dresden	120	430
	22	Scheuten Solar Technology	Gelsenkirchen	90	140
	23	Centrosolar / Solara	Wismar	80	160
	24	Heckert Solar	Chemnitz	60	120
	25	Webasto Solar	Landsberg/Lech	35	20
	26	Asola	Erfurt	30	100
	27	Algatec	Elsterwerda	15	65
	28	Solarnova	Wedel	10	30
	29	GSS	Löbichau	10	30
	30	PVflex Solar	Fürstenwalde	5	30
	31	Schüco Solar	Bielefeld	5	450
Fully Integrated	32	Solarworld[5]	Freiberg	450/300/250	1200
(Wafers/Cells/	33	Conergy[2]	Frankfurt (Oder)[1]	250/250/250	370
Modules)	34	Schott Solar[6]	Alzenau	160/275/200	450
	35	EverQ	Thalheim	100/100/100	1000

Source: Invest in Germany Research, Information provided by the respective company, July 2008



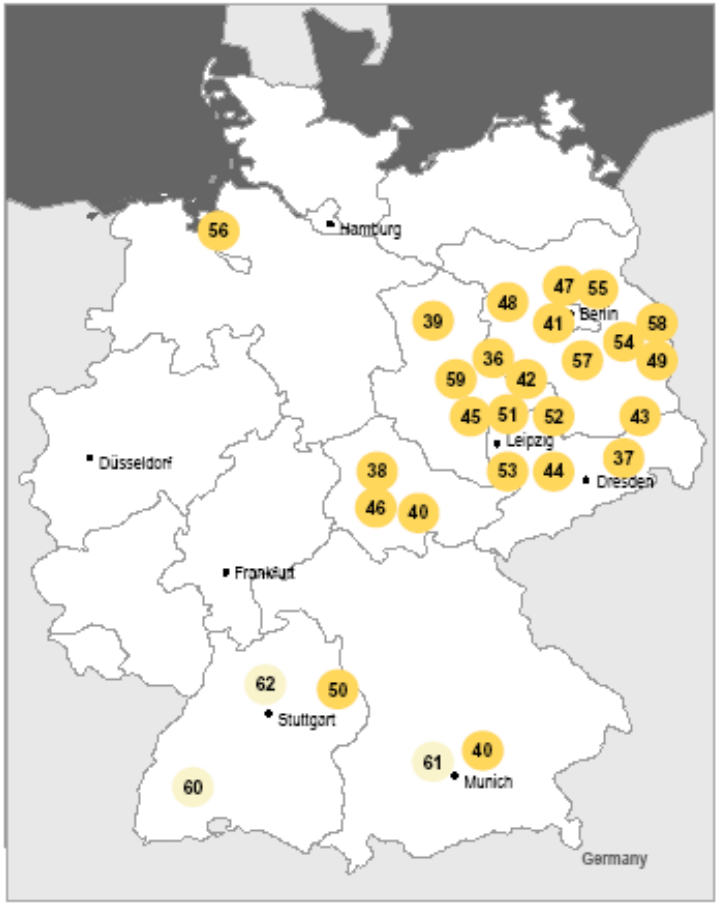
1) Planned/under construction
2) Excluding ingots
3) Subsidary of Ersol
4) Subsidary of Q-Cells
5) Subsidaries of Solarworld: Deutsche Solar, Deutsche Cell, Solar Factory
6) Wafer production by Wacker Schott Solar No. 8

German PV cluster: production thin-film

Value Chain	No.	Company	Location	Capacity 2008 [MWp]	Current Empl.
Thin Film					
Poly-Si	36	CSG Solar	Thalheim	20	150
a-Si	37	Sunfilm	Großröhrsdorf[1]	60	50
a-Si/µc-Si	38	Ersol Thin Film	Erfurt	40	180
	39	Malibu	Osterweddingen[1]	40	150
	40	Schott Solar Thin Film	Jena, Putzbrunn[1]	30	160
	41	Inventux	Berlin[1]	30	n/a
	42	Sontor[4]	Thalheim	25	60
	43	EPV	Senftenberg[1]	25	n/a
	44	Signet Solar	Mochau	20	70
	45	Intico Solar	Halle[1]	n/a	n/a
	46	Masdar PV	Arnstadt[1]	n/a	n/a
CIS	47	Global Solar Energy	Berlin[1]	35	n/a
CIGS	48	Johanna Solar Technology	Brandenburg	30	100
CIGSSe	49	Odersun	Frankfurt (Oder), Fürstenwalde[1]	30	90
	50	Würth Solar	Schwäbisch Hall	30	220
	51	Solibro[4]	Thalheim[1]	25	150
	52	Avancis	Torgau[1]	20	60
	53	Solarion	Leipzig	10	35
	54	PVflex Solar	Fürstenwalde	Pilot	130
	55	Sulfurcell	Berlin	Pilot	120
	56	CIS-Solartechnik	Bremerhaven	Pilot	20
	57	Nanosolar	Luckenwalde[1]	n/a	n/a
CdTe	58	First Solar	Frankfurt (Oder)	175	500
	59	Calyxo[4]	Thalheim	25	40

Companies in concentrator technologies

Value Chain	No.	Company	Location	Capacity 2008 [MWp]	Current Empl.
CPV	60	Concentrix Solar	Freiburg	25	70
	61	SolarTec	Munich	10	50
	62	Archimedes Solar	Stuttgart	n/a	n/a



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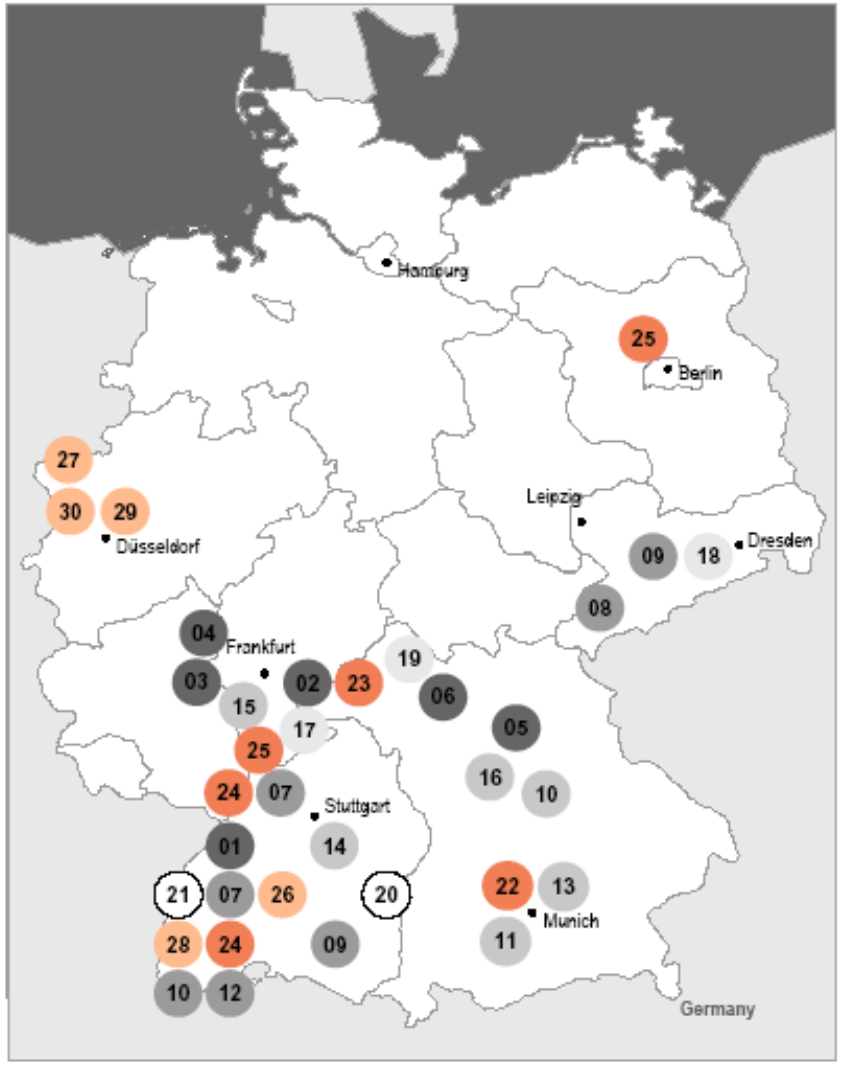
6) Wafer production by Wacker Schott Solar No. 8

Source: Invest in Germany Research, Information provided by the respective company, July 2008

German PV cluster: equipment, wafer-based

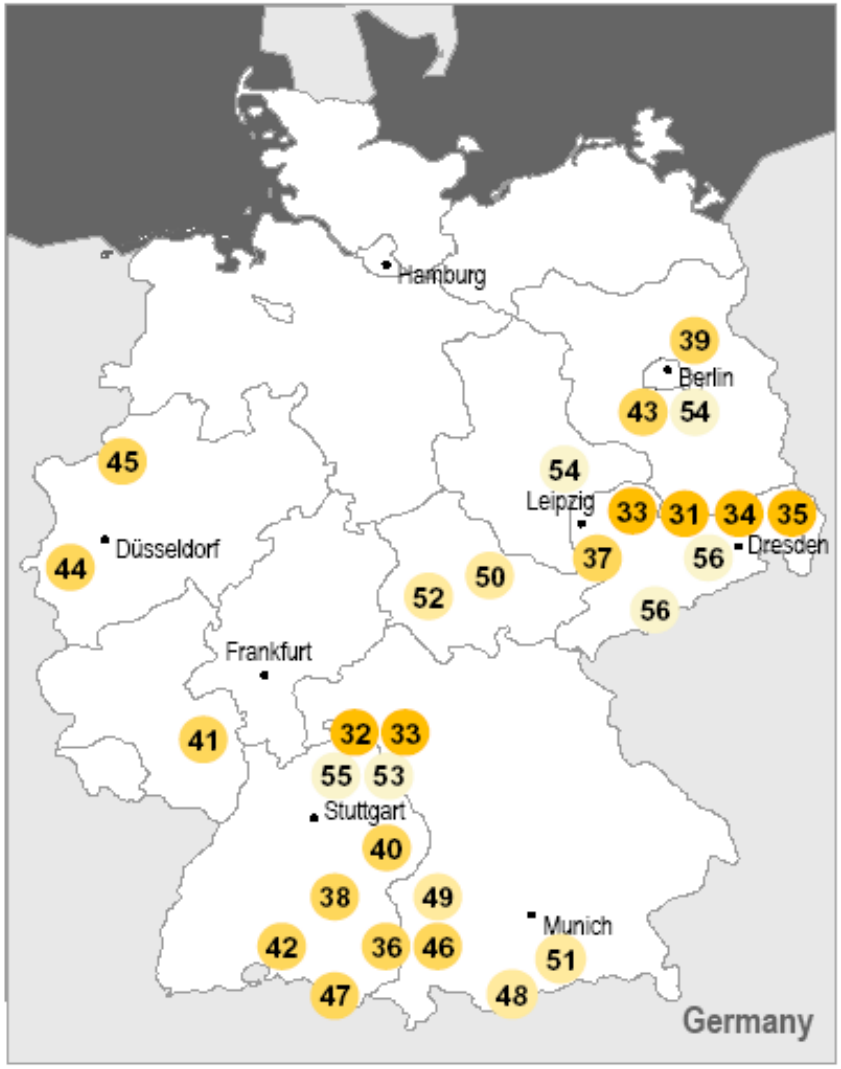
Equipment	No.	Company	Location	Empl.
Ingots/Wafers - Equipment	1	Gebrüder Schmid	Freudenstadt	380
	2	ALD Vacuum Technologies	Hanau	360
	3	Herbert Arnold	Weilburg	130
	4	CGS / PVA Tepla	Asslar	50
	5	G&N	Erlangen	40
	6	Logomatic	Mainaschaff	20
Cells - Turnkey Lines	7	Gebrüder Schmid	Freudenstadt , Schwetzingen	430
	8	Roth & Rau	Hohenstein-Ernstthal	300
	9	Centrotherm Photovoltaics	Blaubeuren, Dresden	200
Cells - Wet Chemistry	10	Rena	Gütenbach, Berg	450
	11	Stangl Semiconductor	Eichenau, Puchheim	100
	12	Lotus Systems	Gutmadingen	70
	13	Ramgraber	Hofolding b. Braunthal	40
	14	HMS Höllmüller	Herrenberg	40
	15	M-O-T	Speyer	20
	16	Decker	Berching	30
Cells - Anti-reflective Coating	17	Applied Materials	Alzenau	500
	18	Von Ardenne Anlagentechnik	Dresden	400
	19	Singulus	Kahl	300
Cells -Screenprinters	20	Manz Automation	Reutlingen	400
	21	Thieme	Teningen	350
Modules - Turnkey Lines	22	Kuka Systems	Augsburg	1200
	22	Reis Robotics	Obernburg	720
	23	Gebrüder Schmid	Freudenstadt, Niedereschach	530
	24	Teamtechnik	Freiberg am Neckar, Berlin	350
Modules - Tabbers, Stringers, Laminators	25	Robert Bürkle	Freudenstadt	350
	26	Meier Vakuumtechnik	Bocholt	170
	27	Somont	Umkirch	100
	28	Robust	Remscheid	50
	29	SunWare	Duisburg	20
	30	Solarwatt	Dresden	20



Source: Invest in Germany Research, Information provided by the respective company, March 2008

German PV cluster: equipment thin-film

Equipment	No.	Company	Location	Empl.
Thin Film - Vacuum Deposition	31	Applied Materials	Alzenau	500
	32	Von Ardenne Anlagentechnik	Dresden	400
	33	Leybold Optics	Alzenau, Dresden	320
	34	FHR Anlagenbau	Ottendorf-Okrilla	90
Automation	36	ASYS Automatisierungssysteme	Dornstadt	300
	37	USK Karl Utz Sondermaschinen	Limbach-Oberfrohna	260
	38	Manz Automation	Reutlingen	250
	39	Jonas & Redmann Photovoltaics	Berlin	240
	40	Schiller Automation	Sonnenbühl-Genkingen	200
	41	Minitec Maschinenbau	Waldmohr	140
	42	ACI-ecotec	St. Georgen	70
	43	Feintool Automation	Berlin	60
	44	Maschinenbau Gerold	Nettetal	50
	45	Olbricht	Hamminkeln-Brünen	30
	46	Amb bernhard brain	Gersthofen	20
	47	Mondragon Assembly	Stockach	20
Laser Processing	48	Carl Baasel	Stamberg	350
	49	Manz Automation	Reutlingen	300
	50	Jenoptik Automatisierungstechnik	Jena	170
	51	InnoLas	Krailling	80
	52	LPKF SolarQuipment	Suhl-Friedberg	40
Fab Engineering and Planning	53	M+W Zander FE	Stuttgart	400
	54	IB Vogt	Berlin, Thalheim	160
	55	Caverion	Stuttgart	160
	56	AiC	Chemnitz, Dresden	80



Source: Invest in Germany Research, Information provided by the respective company, March 2008

EPIA is more ambitious: Towards PV competitivity in Europe

European Photovoltaic Industry Association EPIA:

- Realistic learning curve:
  100% increase of installed PV → 20% cost reduction

→ Step by step grid parity will be reached in all important markets in the coming years

	2008	2012	2016	2020
Share of EU electricity markets where grid parity is reached	0%	10%	50%	90%

EPIA proposes as target for EU policies :

- Cumulative PV installed in Europe 2020 : 350 GWp
- PV share of EU electricity generation : 12%
- Annual growth rate of installed PV base : 40%

German Renewable Energy Association: Prognosis exceeds EU targets

Share of total electricity production in Germany

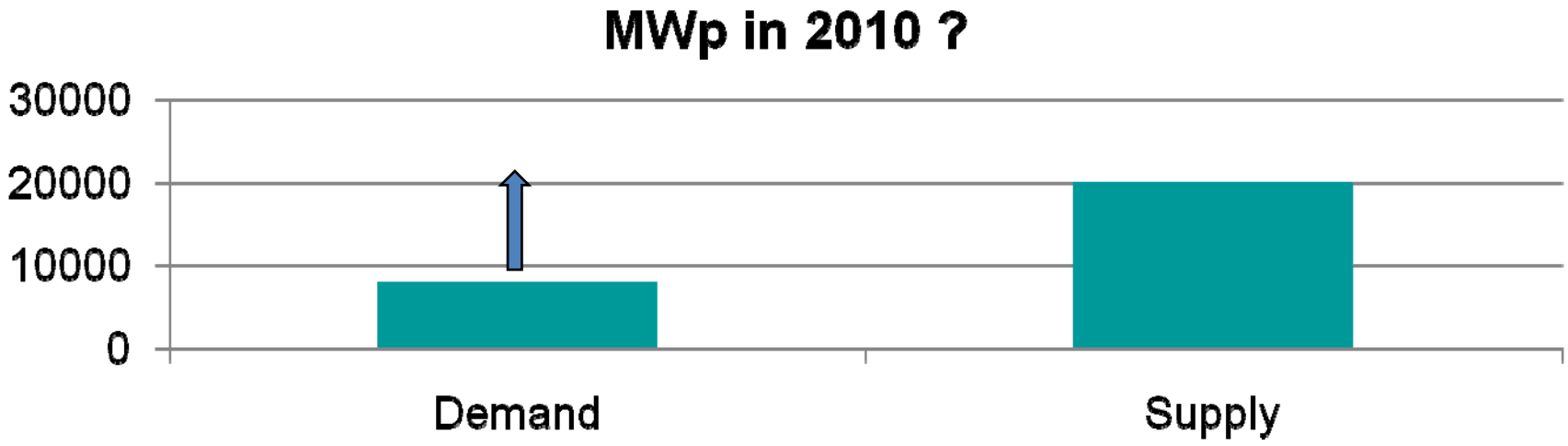
	share 2020	growth 2007-2020
• Biomass	9%	+119%
• Geothermie	1%	
• PV	7%	+1217%
• Hydro	5%	+54%
• Wind onshore	19%	+182%
• Wind offshore	6%	
• **TOTAL**	**47%**	

Independent from the economic crisis: worldwide PV overcapacity

- Announcements for production in 2010 amount to 20 GWp
- Demand estimates range between 4 and 14 GWp

→ Big efforts in market development are necessary

→ Only strong and high quality producers will survive



The crisis: impact on business

- Medium term growth prospects for renewables better than ever
- Credit crunch brings problems to project financing – utilities and private investors not touched
- Government aid programs support growth of renewables – safe haven for investments
- PV - a special case:
  - overcapacity brings consolidation of the sector
  - emphasis on quality
  - sinking prices, increased competitiveness
  - new markets needed
- Low oil price: temporary problems
- Cooperation needed to manage strong growth

Need to speed up a collective global learning process

- Developing and introducing new products, new markets, new regulations, new skills, new system configurations requires a huge learning process involving a large variety of actors
- Enhancing global experience exchange can make a big difference
- Existing international energy organisations are learning too slowly or are too weak for tackling this challenge

→ There is a need for a new strong global cooperation agency standing for this new international priority

IRENA – the profile

- INTERNATIONAL RENEWABLE ENERGY AGENCY
- Members: open to UN members
- Regular budget: > 25 Million US$
- Funding: mandatory contributions according to UN key + voluntary contributions
- Personnel: > 150
- Headquarters: to be defined, several countries interested
- Objective: to promote the widespread and increased adoption and the sustainable use of renewable energy

IRENA's tasks

- review, systematise and monitor current renewable energy practices
- cooperate closely with other organisations and networks in this field
- provide relevant policy advice and assistance to its members
- improve pertinent knowledge and technology transfer
- offer capacity-building
- provide advice on the financing for renewable energy, support the application of related mechanisms
- stimulate and encourage research
- participate in and inform about the development of national and international standards
- disseminate information and increase public awareness

IRENA's initial work programme (1): capacity building tasks

1. Developing a comprehensive knowledge base
   - Taking stock of existing knowledge and activities
   - Developing a reporting system and extensive database
2. Networking
   - Cooperating with other organisations, institutions and networks
   - Consulting with experts from academia and industry
3. Communication
   - Establishing an Internet-based communication platform
   - Strengthening international dialogue on renewable energy
   - Developing a key publication
   - Building media relations

IRENA's initial work programme (2): initial activities

1. Advising national governments in developing an integrated approach to promoting renewable energy
2. Integrating renewable energy into the urban environment
3. Strengthening strategic cooperation in rural areas
4. Identifying training needs and opportunities for developing renewable energy
5. Increasing the share of renewable energy used in existing energy systems
6. Promoting technology transfer
7. Raising the profile of renewable energy in the energy and climate debate

Renewable energy: a promising answer to urging problems

- Discussions about "burden sharing" in international climate policy → defensive and time consuming negotiations
- Renewable energy is not a burden but a huge opportunity at local, regional, national and international levels, frees constructive energies
- The problems to solve:
  - how to manage the transition
  - how to organise rapid learning and experience exchange
  - how to transform the role of traditional centralised structures
- Cooperation is needed
  - Between business and government
  - Within industry , between steps of the value chain
  - Between different countries
- Innovative business and emerging markets to play key role
  - Improving competitiveness of renewable energies
  - Creating new markets
  - Inventing new structures

THANK YOU

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