The Industry's View of Photovoltaics in Europe

7th National PV Conference - Swiss

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European Photovoltaic Industry Association

ERECC

WHAT IS EREC ?

Created in 2000, the European Renewable Energy Council - EREC - is an umbrella organisation of the European renewable energy industry, trade and research associations active in the fields of photovoltaic, small hydropower, solar thermal, biomass, wind energy and geothermal energy, thus representing the entire renewable energy sector.

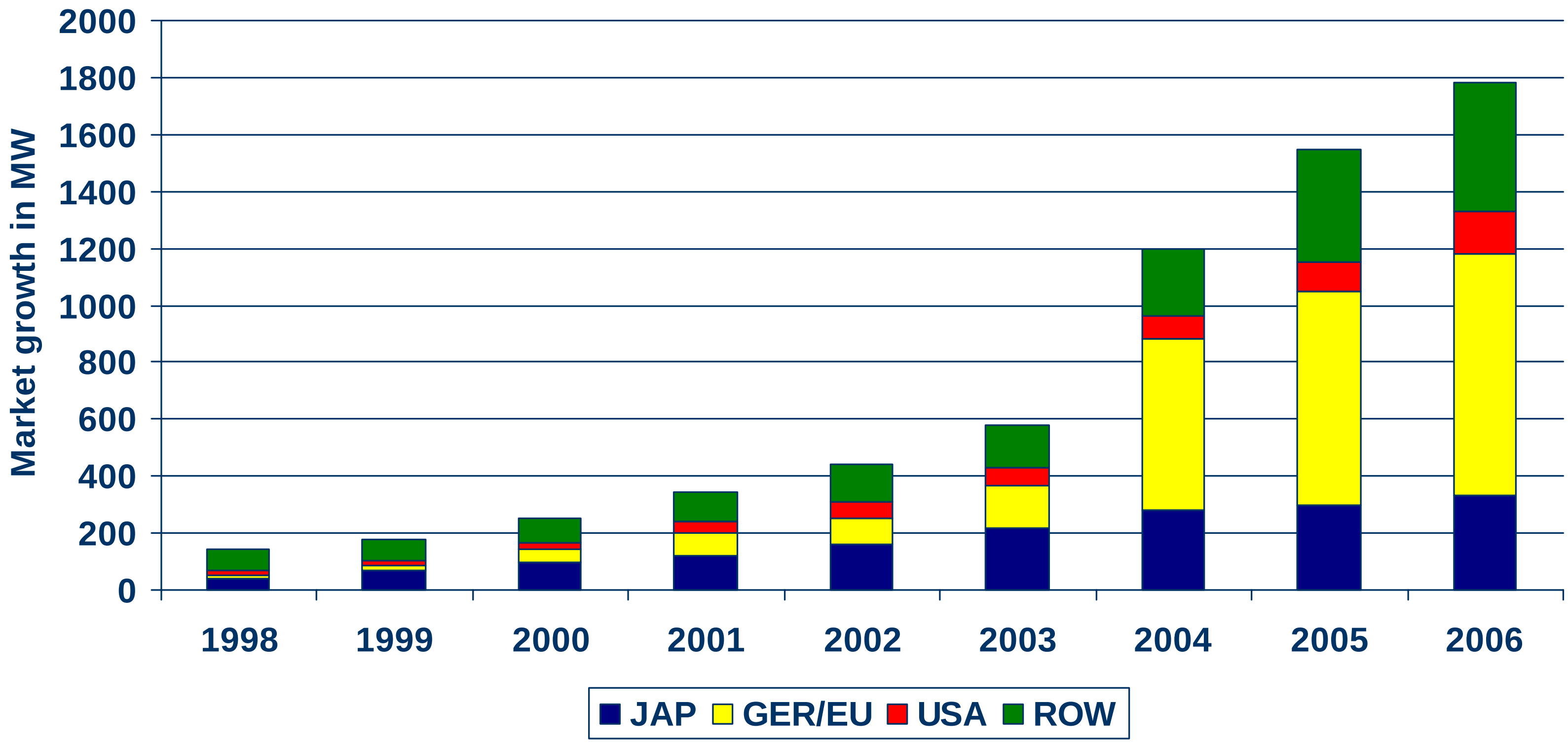
EREC is composed of the following non-profit associations and federations:

AEBIOM (European Biomass Association), EGEC (European Geothermal Energy Council), EPIA (European Photovoltaic Industry Association), ESHA (European Small Hydropower Association), ESTIF (European Solar Thermal Industry Federation), EUBIA (European Biomass Industry Association), EUREC Agency (European Renewable Energy Research Centres Agency), and EWEA (European Wind Energy Association).

More information on EREC and its member associations: www.erec-renewables.org.

EPIA
European Photovoltaic Industry Association

Historical Market Development by Regions



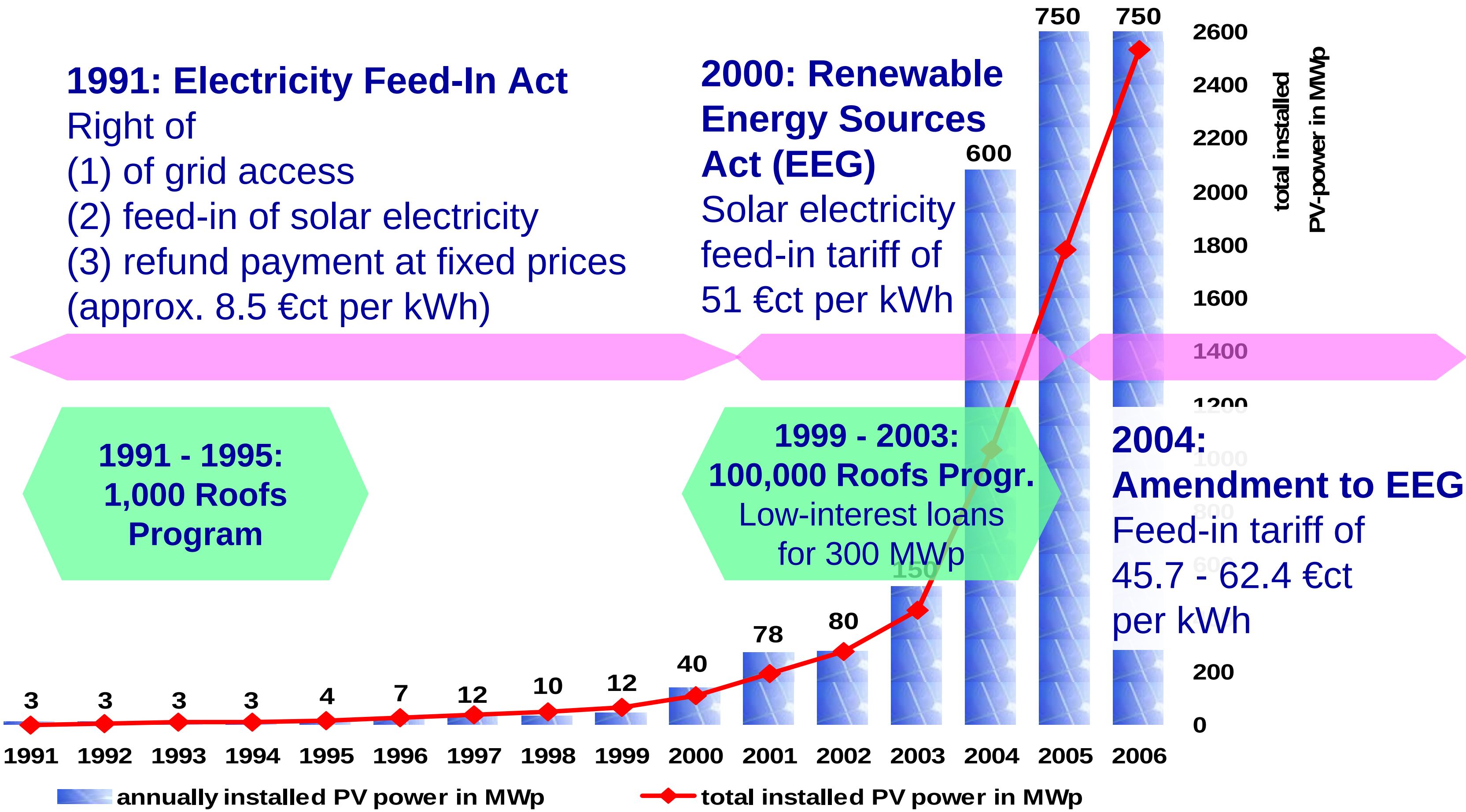
ref: European Photovoltaic Industries Association (EPIA) & Navigant Consulting

European Market Support Programs

Country	Feed-in law			yearly market [MW]	
	Tariff [€ct/kWh]	Duration [a]	Cap [MW]	2005	2006 (est.)
Germany	38 – 49 BIPV + 5ct	20	-	750	750
Italy	36 – 49	20	1,200	5	12
Portugal	31 – 45		150	1	1
Spain	22 – 41	25	400	20	63
France	30 - 40 BIPV + 15-25	20	-	5	12
Greece	40 – 50	20		1	1
other countries	Feed in Laws: Switzerland (1991); Denmark (1993); Sweden (1997); Norway, Slovenia (1999); Latvia (2001); Austria, Czech Republic, Lithuania (2002); Cyprus, Estonia, Hungary, Slovak Republic (2003); Turkey, Ireland (2005)				

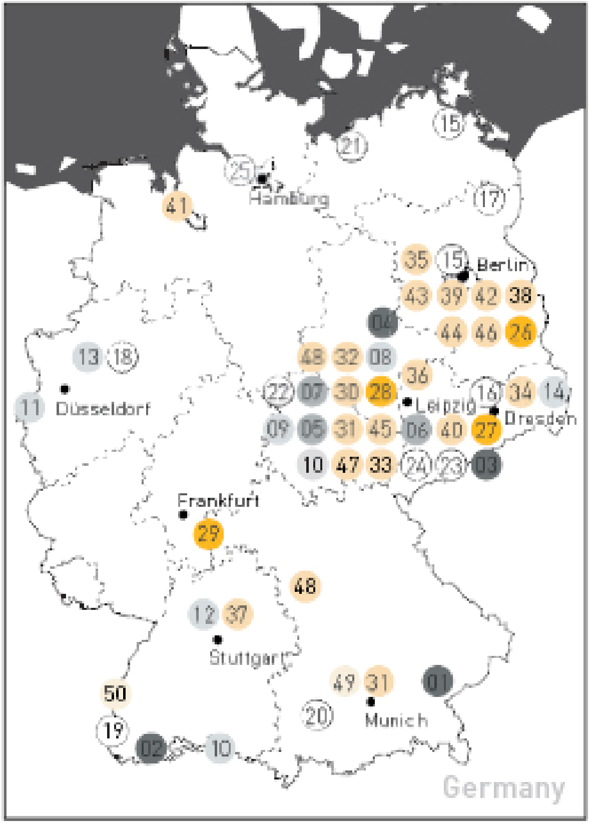
ref: European Photovoltaic Industries Association (EPIA)

Development of the German PV-market



ref: Bundesverband Solarwirtschaft, Germany)

Value chain		Company	Location	Capacity 2007 (MWp)	Empl.
Silicon	1	Wacker Chemie	Burghausen	6000t	920
	2	Joint Solar Silicon	Rheinfelden[2]	100t	-
	3	Scheuten SolarWorld Solizium	Freiberg[1]	-	-
	4	City Solar	Wolfen-Bitterfeld[1]	-	-
Wafers	5	ASi Industries[3]	Arnstadt	100	160
	6	WPI Wafer Production Int.	Leipzig	100	40
	7	PV Silicon	Erfurt	n.a.	120
Cells	8	Q-Cells	Thalheim	645	940
	9	Ersol Solar Energy	Erfurt, Arnstadt[2]	180	230
	10	Sunways	Konstanz, Arnstadt	45	130
	11	Solland Solar Cells	Aachen	20	120
	12	Solarwatt Cells	Heilbronn	15	60
	13	Scheuten Solar Cells	Gelsenkirchen	n.a.	80
	14	Arise Technologies	Bischofswerda[1]	-	-
Modules	15	Solon	Berlin, Greifswald	110	310
	16	Solarwatt Solar-Systeme	Dresden	100	320
	17	Aleo Solar	Prenzlau	90	280
	18	Scheuten Solar Technology	Gelsenkirchen	80	130
	19	Solar-Fabrik	Freiburg	50	200
	20	Systaic	Landsberg am Lech	35	10
	21	Solara Sonnenstromfabrik	Wismar	25	100
	22	ASS Automotive Solar Systems	Erfurt	25	50
	23	Heckert-B.X.T. Solar	Chemnitz	25	40
	24	GSS	Löbichau	15	30
	25	Solarnova	Wedel	10	30

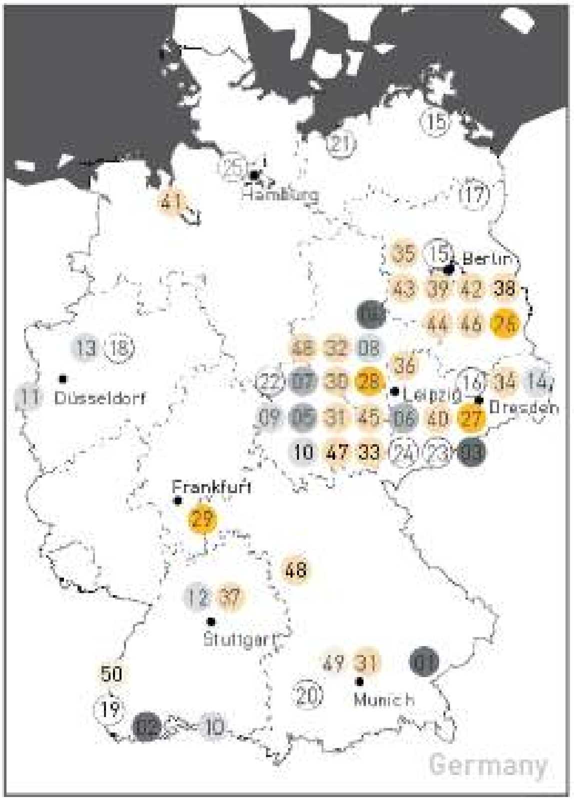


1) Planned
2) Under construction
3) Subsidiary of Ersol
4) Subsidiaries of Solarworld: Deutsche Solar, Deutsche Cell, Solar Factory
5) Subsidary of Q-Cells

Source: IiG research, April 07

PV Companies in Germany I

Fully Integrated	26	Conergy	Frankfurt (Oder)[2]	300/275/250	80
Wafers/Cells/ Modules	27	Solarworld[4]	Freiberg	270/160/n.a.	810
	28	EverQ	Thalheim	100/100/100	480
	29	Schott Solar	Alzenau	20/115/25	450
Thin Films					
poly-Si	30	CSG Solar	Thalheim	20	140
a-Si a-Si/µc-Si	31	Ersol Thin Film[3]	Erfurt[2]	40	40
	32	Brilliant 234.[5]	Thalheim[2]	25	10
	33	Schott Solar	Jena, Putzbrunn[2]	20	80
	34	Sunfilm	Großröhrsdorf[1]	-	-
CIS CIGS CIGSSe	35	Johanna Solar Technology	Brandenburg[2]	30	70
	36	Avancis	Torgau[1]	20	n.a.
	37	Würth Solar	Schwäbisch Hall	15	180
	38	Odersun	Frankfurt (Oder)	n.a.	n.a.
	39	Sulfurcell Solartechnik	Berlin	Pilot	60
	40	Solarion	Leipzig	Pilot	20
	41	CIS-Solartechnik	Bremerhaven	Pilot	20
	42	PVflex Solar	Fürstenwalde	Pilot	20
	43	Global Solar Energy	Berlin[2]	n.a.	n.a.
	44	Nanosolar	Luckenwalde[1]	n.a.	n.a.
	45	Solibro[5]	Thalheim[1]	-	-
CdTe	46	First Solar Manufacturing	Frankfurt (Oder)[2]	100	380
	47	Antec Solar Energy	Arnstadt	10	100
	48	Calyxo[5]	Thalheim[2]	25	20
CPV	49	SolarTec	Munich	Pilot	30
	50	Concentrix Solar	Freiburg	Pilot	30



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Source: IiG research, April 07

PV Companies in Germany II

Customer Needs

on-grid | **off-grid** | **consumer** | **high efficiency**



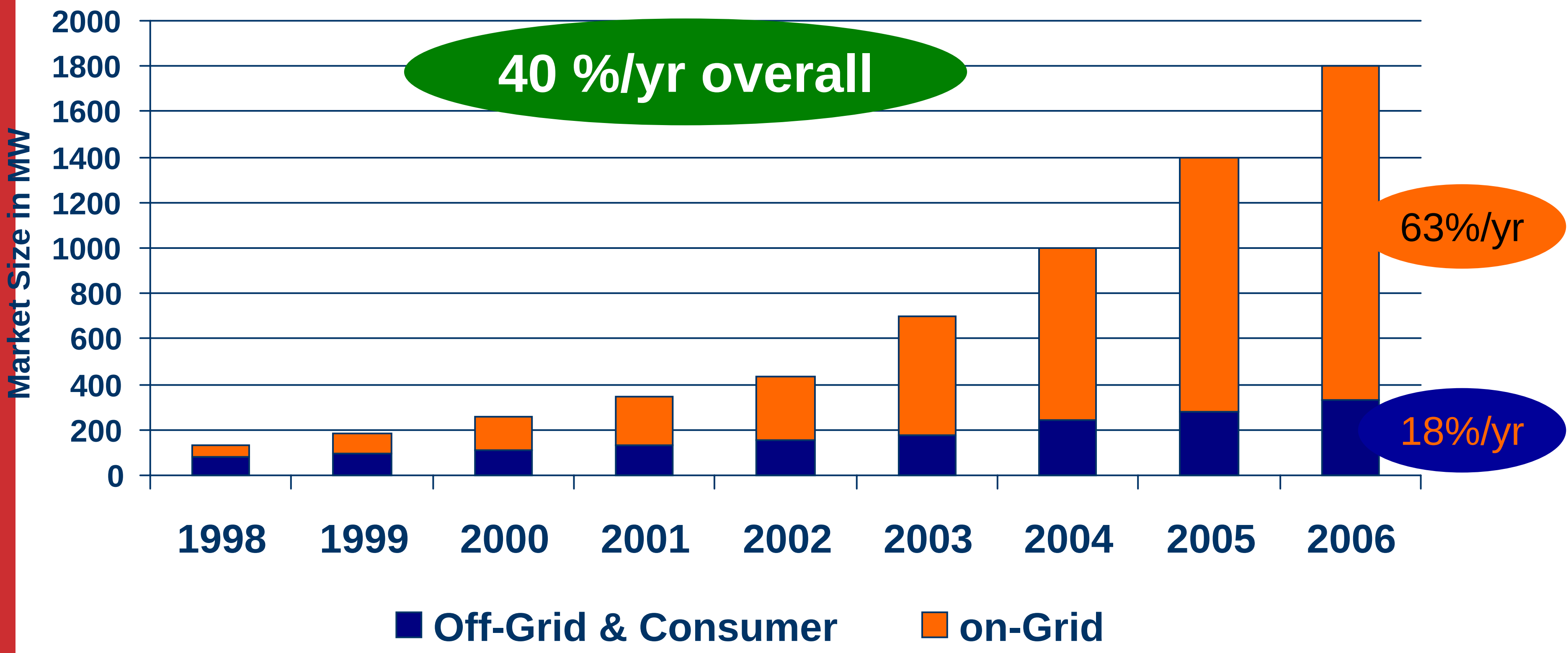

€/kWh | €/hr light | W/m² | g/W




Source: Fraunhofer ISE

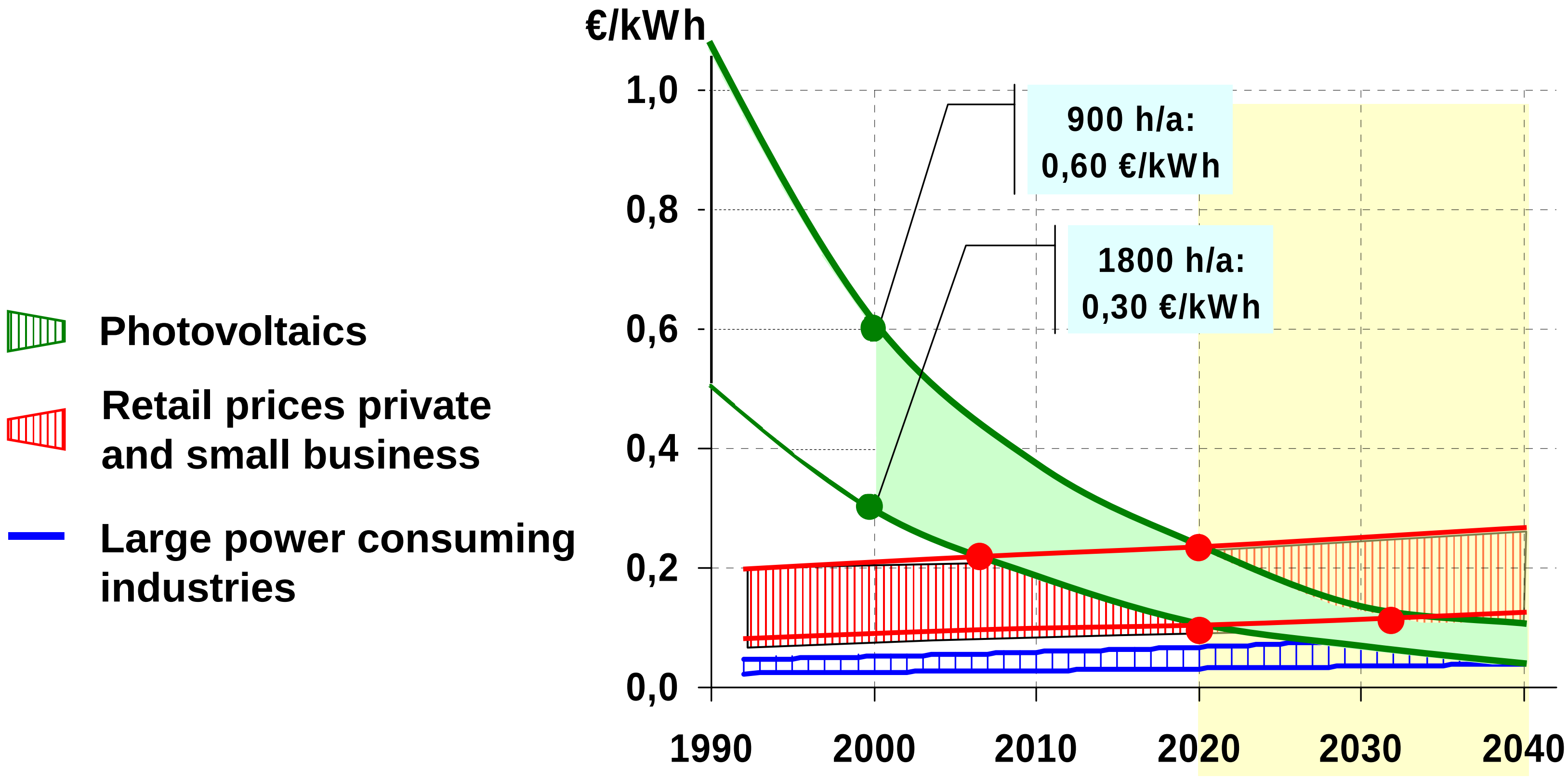
€/m² / aesthetics | €/W | flexibility | W/mm²

World PV Application Segmentation



ref: European Photovoltaic Industries Association (EPIA) & Navigant Consulting

Competitiveness between Electricity Generating Cost for PV and Utility Prices

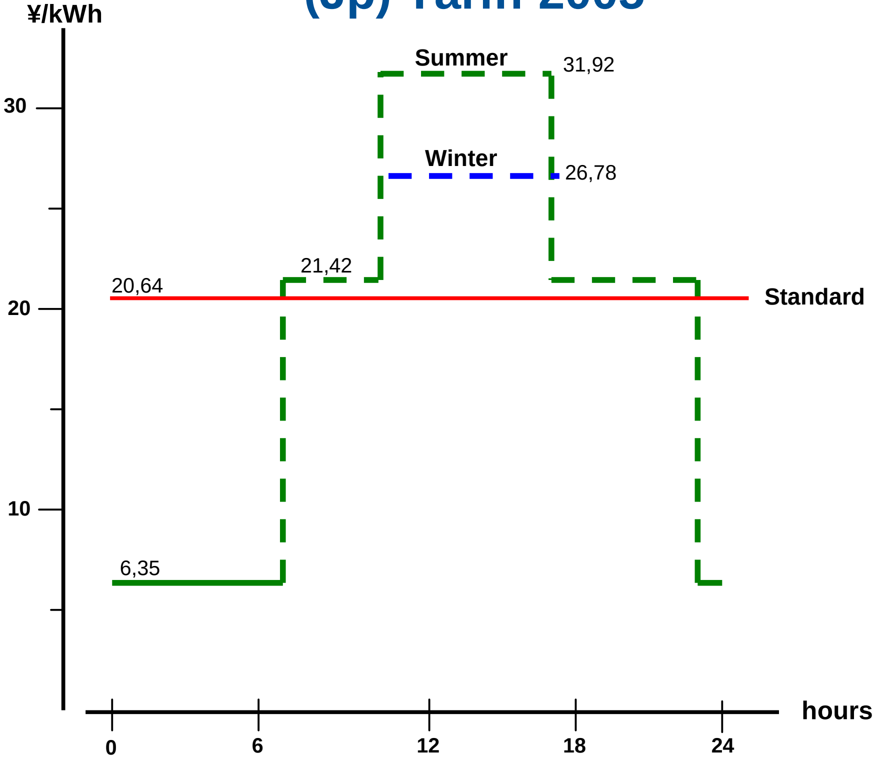


market support programs necessary:

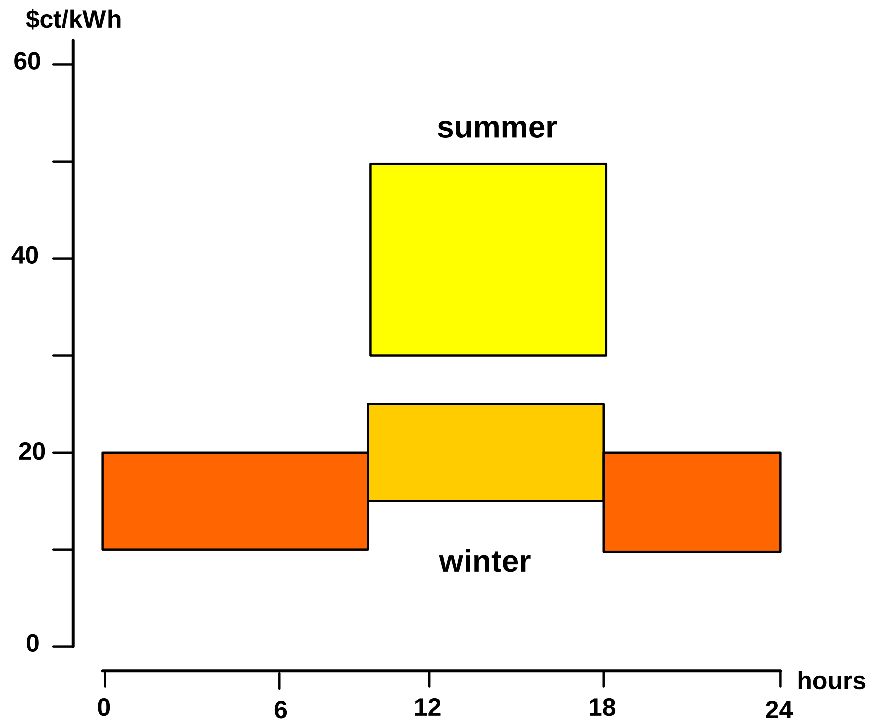
Source: RWE Energie AG and SCHOTT Solar GmbH

Seasonal Electricity Prices

Tokyo Electric Power Cooperation (Jp) Tariff 2005



Range of Electricity Prices in California

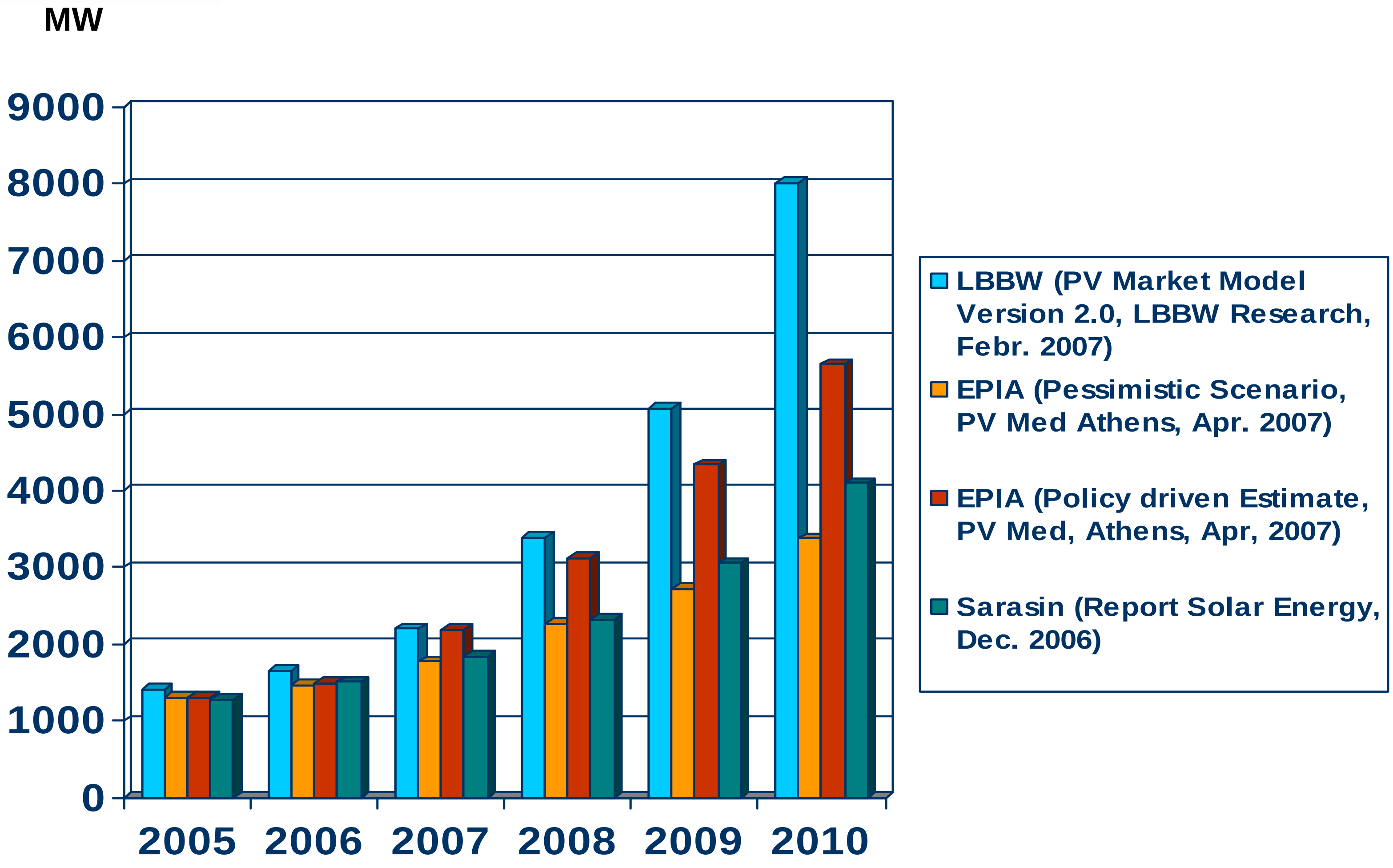


ref: Japan = KEPCO office data ; California = Alison Hyde of BSW

Liberalization of Utility Markets in Europe

- **Unbundling in many countries ongoing**
- **Liberalized market situation in progress following EU directive for the electricity sector**
- **Similar differentiation for electricity prices like in California will develop**

Different World PV Market Projections until 2010 (Status: 2006/2007)

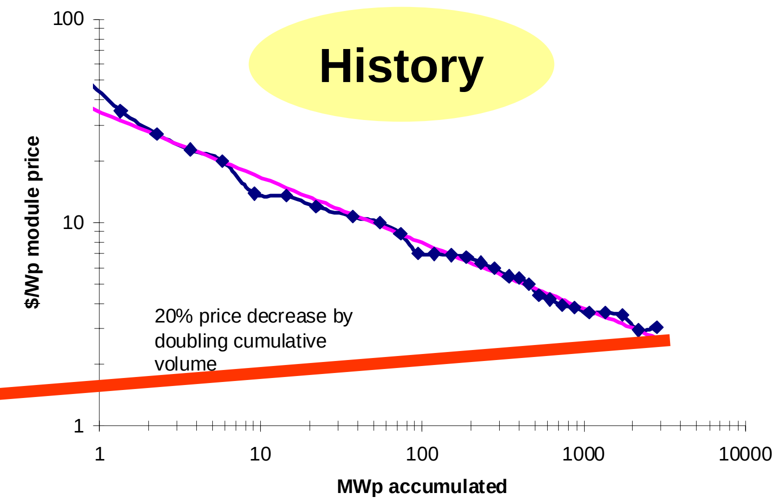


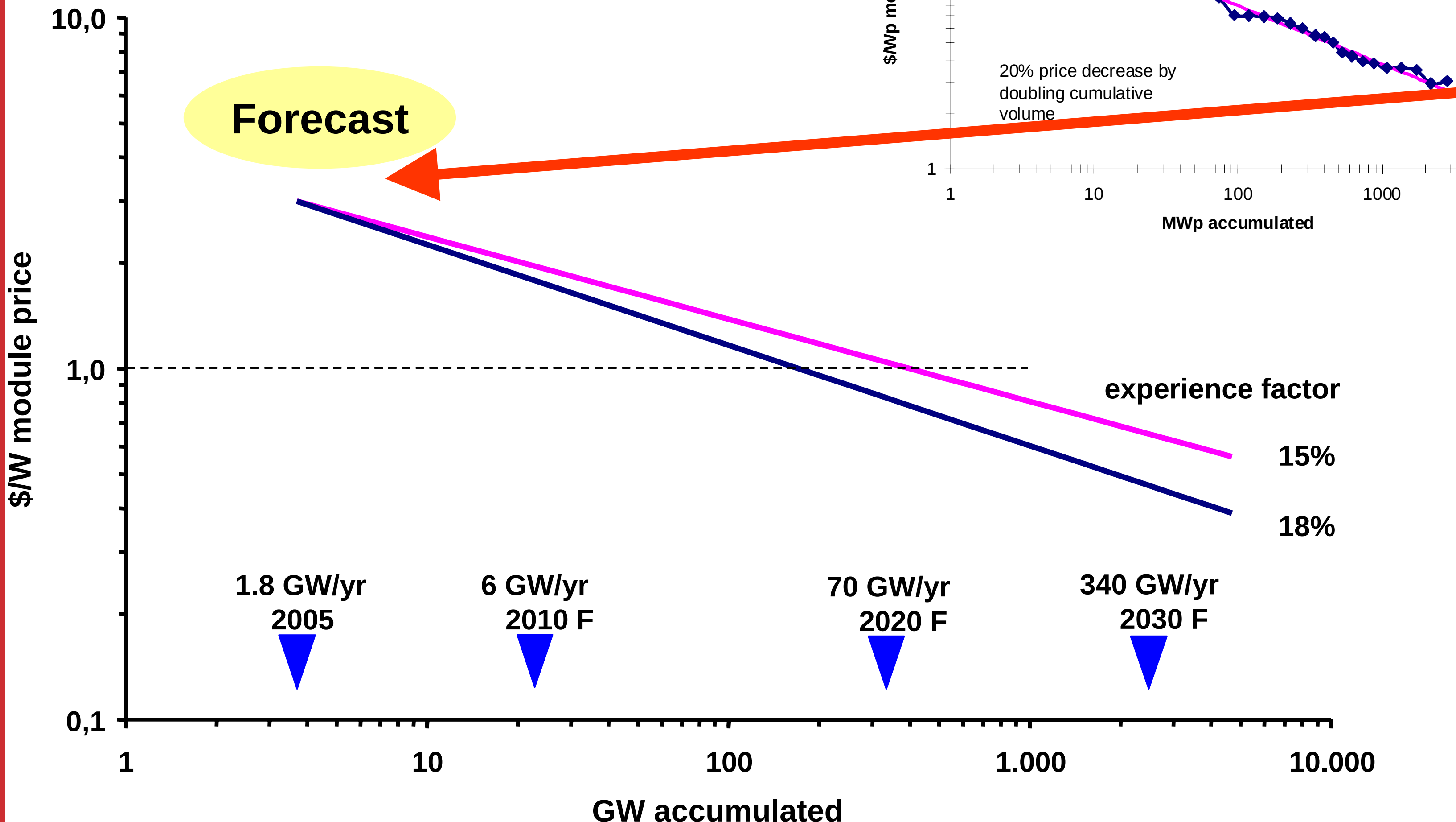
Industry Estimates from the Workshop for Annual Installations

	2006	2007	2008	2009	2010
Germany	850 MW	935 MW	1075 MW	1235 MW	1400 MW
Japan	310 MW	360 – 450 MW	420 – 550 MW	480 – 700 MW	540 - 900 MW
USA	130 MW	170 – 300 MW	215 – 450 MW	270 - 700 MW	340 - 900 MW
Spain	45 MW	50 - 90 MW	100 - 175 MW	150 - 300 MW	250 - 400 MW
Italy	8 MW	35 MW	40 - 150 MW	70 - 300 MW	100 - 400 MW
France	15 MW	45 - 80 MW	60 - 150 MW	80 - 225 MW	100 - 300 MW
Greece	0.6 MW	20- 40 MW	40 - 80 MW	70 - 150 MW	100 - 300 MW
Portugal	2 MW	14 MW	32 - 60 MW	40 - 90 MW	50 - 150 MW
China	12 MW	17 - 50 MW	25 - 80 MW	35 - 130 MW	50 – 200 MW
South Korea	15 - 35 MW	20 - 50 MW	40 - 80 MW	70 - 140 MW	100 - 200 MW
India	12 MW	17 – 50 MW	25 – 80 MW	35 - 130 MW	50 – 200 MW
Rest	50 MW	70 MW	100 MW	140 MW	200 MW

This table was done according to the discussion of the PV industry in Frankfurt 21. December 2006. Either growth rates or newly installed MWp (in absolute numbers) were stated for different years for the major world markets. However, not every single year was discussed for every country. Therefore, a number of figures are done by extrapolating from stated figures. Estimates varied sometimes significantly. It was tried to display the voice of the majority. There was also agreement to reach 5.6 MW in a policy driven scenario and 3.1 MW in a pessimistic scenario by 2010. The figures are in correspondence with this scenario.

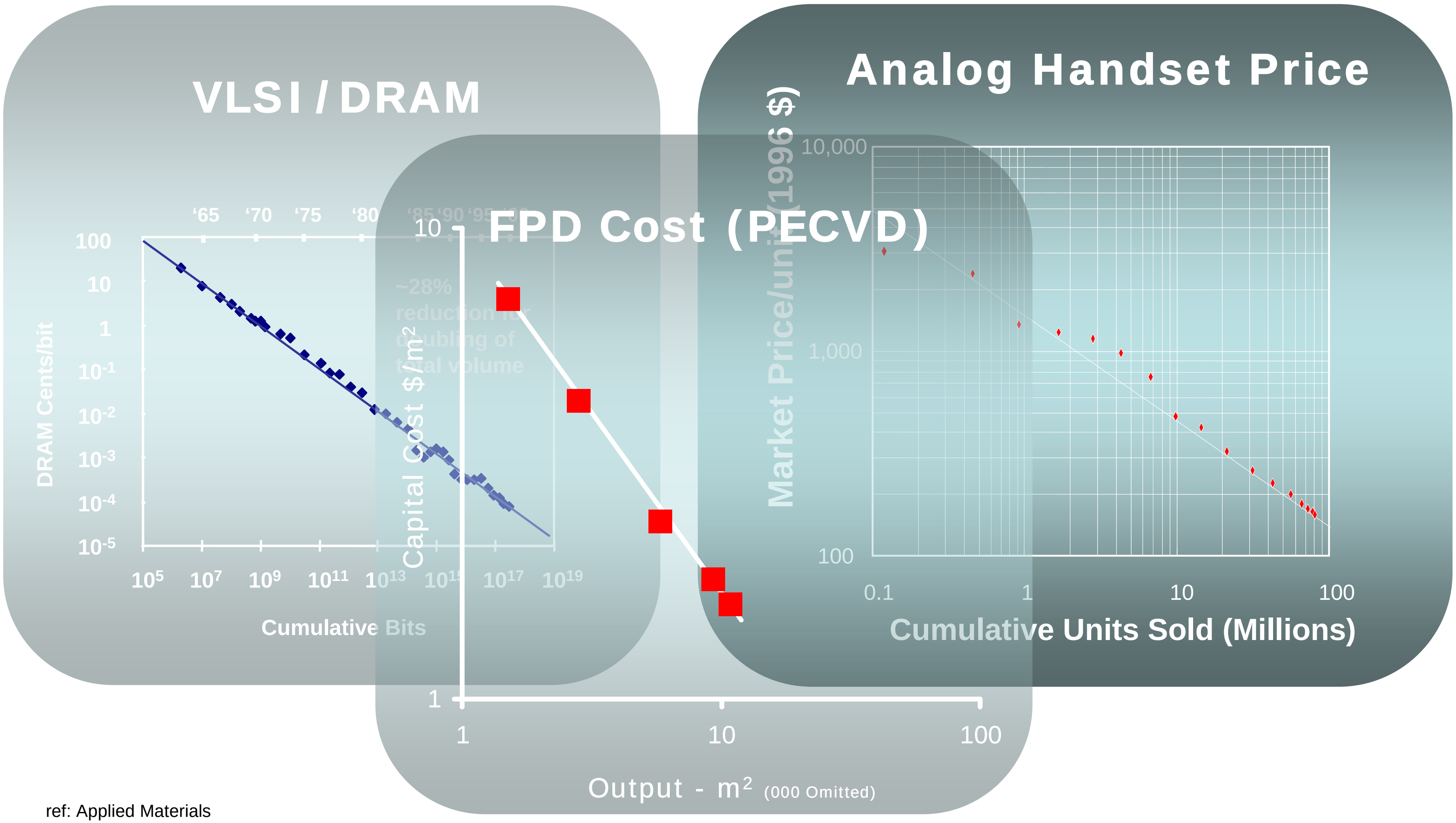
Experience Curve for PV Solar Modules





ref: European Photovoltaic Industries Association (EPIA) and W. Hoffmann personal estimates

Cost/Learning Curve Examples



ref: Applied Materials

Electricity generating cost [€ct/kWh] Eurelectric / VGB Power Tech	Today 2005	Tomorrow 2030	Day after tomorrow 2050
Fossile (coal, gas)	4 - 4.5	6-7	6.5 - 9
Nuclear (PWR, HTR, FBR)	4 – 6	3.5 – 7	3.5 - 6
PV solar electricity (south/north)	20/40	5/10	3/6

= own estimates

ref: EURELECTRIC and W. Hoffmann personal estimates

Thank You

Apologies and Best Wishes!

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