



Q-CELLS AG

**Solar Cells and Modules:
A rapid evolution in technologies
and costs**



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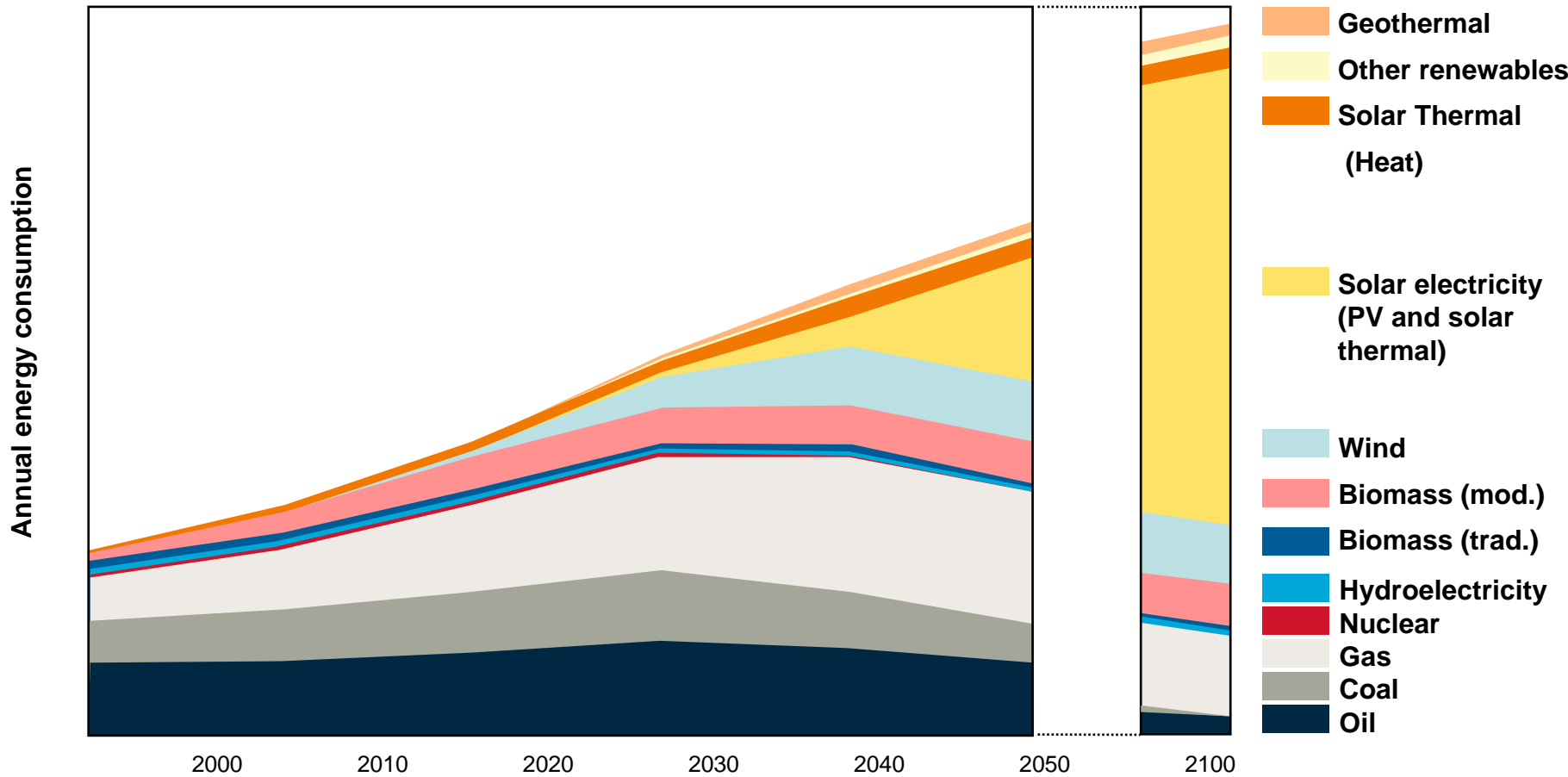


Agenda

- **The Photovoltaic Market – Our Expectations**
- **Q-Cells Strategy: Growth & Cost reduction**
- **Cost reduction focus shift from €/W to €/kWh**
- **Q-Cells: Unique Technology Portfolio**



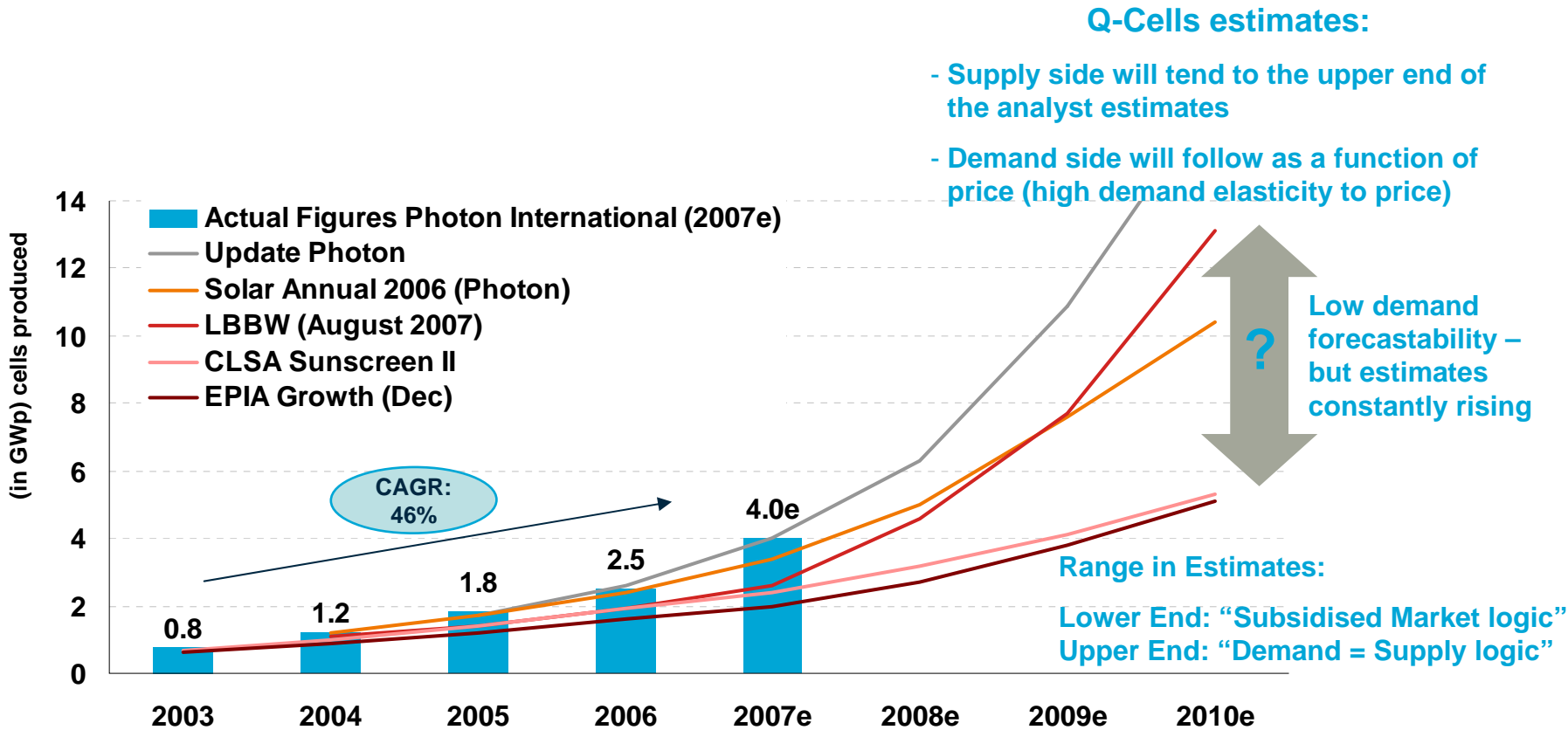
Development of Energy Demand



Source: German Advisory Council on Global Change, Berlin 2003



Photovoltaic Market Development



Favourable development with expected growth rates of 22 – 60% p. a. generally foreseen. Up to now in a supply constrained world, a CAGR of 46% 2003-2006 has been achieved. We expect acceleration of this as more supply comes on-line.



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Main Strategic Priorities and Levers

Mission:

Developing solar electricity to become a main energy source world-wide



Growth strategy

Cost reduction strategy

Main strategic levers

- Plant and capacity expansion
- Feedstock security for growth
- High value-added products/brands
- Customer base expansion, diversification and internationalisation
- Product development
- Technology improvements
- Productivity
- Scale economies
- Other (e.g. manufacturing value-add, Globalisation)

The overriding strategy is to rapidly drive down costs and expand quickly





Q-Cells growth history – to be continued

Company Description

- Pure play company
- Core activities include development, production and marketing of mono- and polycrystalline solar cells
- Strong operating track record
- Strong focus on Research and Development as well as new technologies
- Strategy: Growth and cost reduction

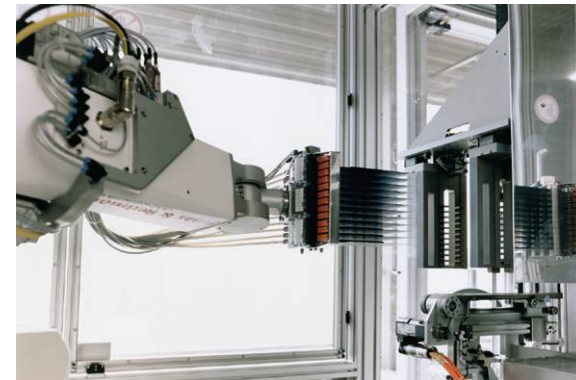


Key Figures

	2002	2003	2004*	2005*	2006*
Production (in MWp)	9.3	27.7	75.9	165.7	253.1
Sales (in EURm)	17.3	48.8	128.7	299.4	539.5
EBIT (in EURm)	0.9	5.3	19.6	63.2	129.4
Net income (in EURm)	0.2	3.0	12.0	39.9	87.7**
Employees	82	207	484	767	964

* Consolidated Financial Statements

** After minorities and plus one-off income amounting to 9.4 EURm





Technology – Strategy to reduce costs

Focus on main technologies with higher commercial potential in the coming years

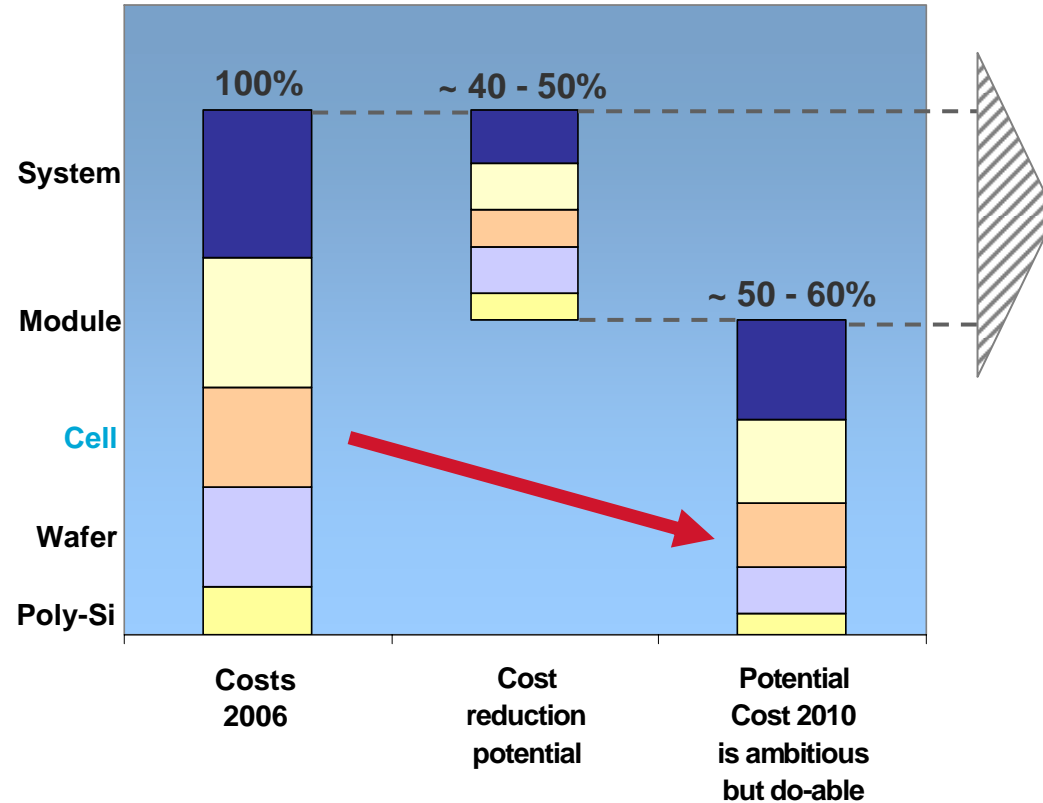
Crystalline Silicon				Thin Film					Flexible	High Con-centr.	Organic	Others
Poly	Mono	String Rib-bon	Low con-centr.	CSG	μ -Si	a-Si	CdTe	CIGS		Ga AS		



Sources of Cost Reduction: Core Business Areas

Cost Reduction Potential in EUR/Wp

Example: Multi-Crystalline



“Scaling”

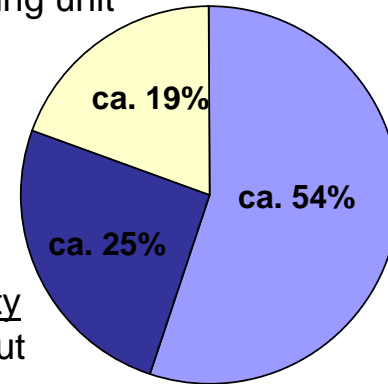
- Getting bigger
- Reducing unit costs
- Invest

„Technology Driven“

- Efficiency
- Thickness
- Kerf loss
- Longevity
- Etc.

“Productivity

- Cost Input
- Yield
- Manufacturing excellence
- Standardisation etc

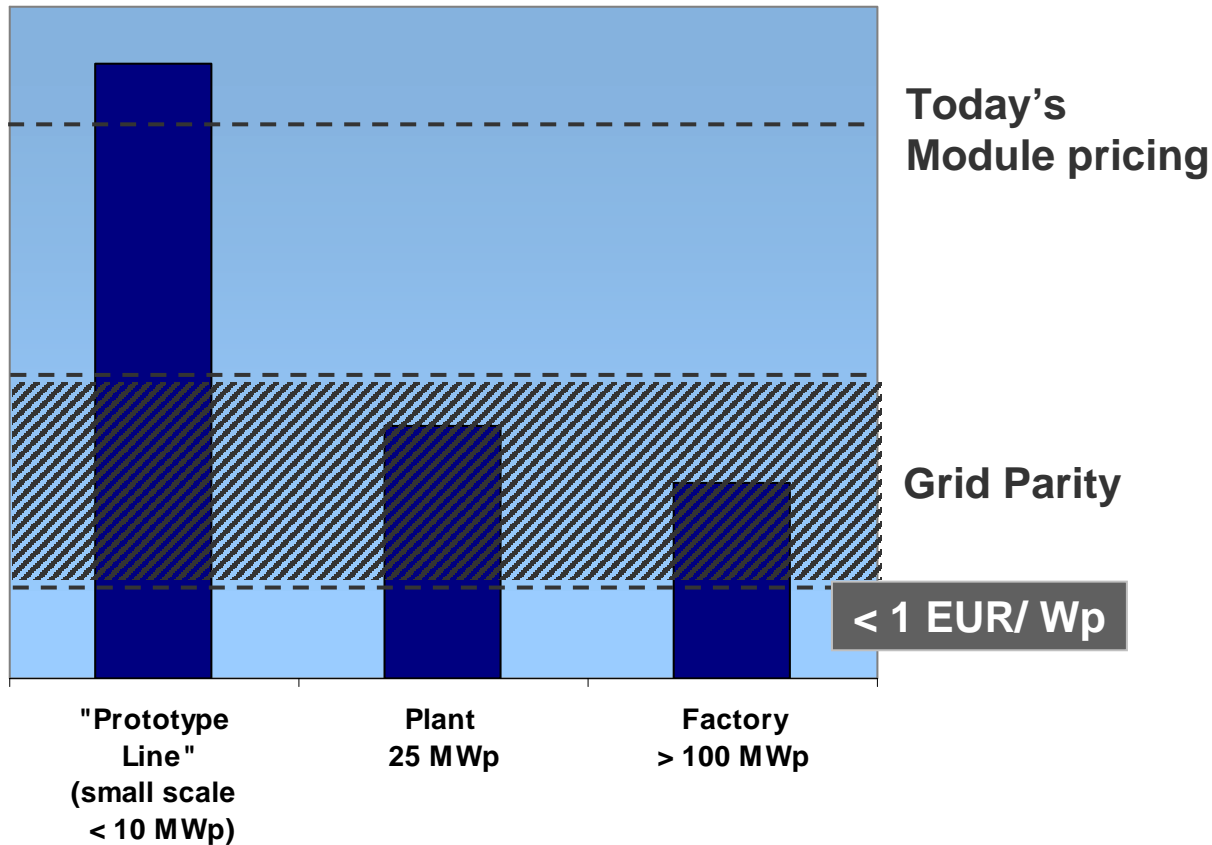


Main Driver: Technology/Time



Sources of Cost Reduction: Thin-Film Businesses

Cost Reduction Potentials – Thin-Film





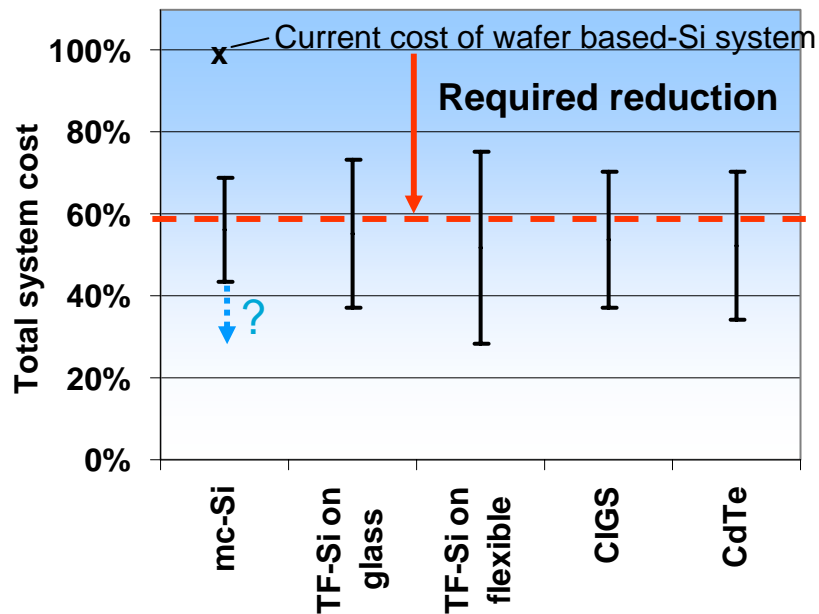
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Technologies – Strategic Thinking 2004

Forecast of System Costs in 2010+



Consequences

- Si-wafer-based technologies still have a large potential for cost reductions
- **Large bandwidth of attainable system costs for thin films as well as Si-wafer based PV → no clear winner**
- The thin film technologies might reach system costs below those of Si-wafer based technologies
- Only the best players with the best technologies will reach competitiveness

Investment criteria: Cost, commercial potential and near-term commercialization



Cost reduction focus shift from €/W to €/KWh

Plus some qualitative differentiators for certain markets (e.g. esthetics, weight, ...)

- €/Wp focus (module costs):**
- **Not site-specific parameter**
→ Technologies easier to compare
 - **One clear winning technology possible**
→ Technology portfolio as far as projected cost ranges overlap

- Differentiation of technologies due to e.g. ...**
- ... **Radiation:**
Direct vs. diffuse light
 - ... **Temperature:**
Desert vs. mountain
 - ... **Tracking:**
Fixed vs. 1- or 2-dimensional tracking
 - ... **Area Costs:**
Roof top in Tokyo vs. desert field
 - ...

- €/KWh focus:**
- **Site-specific parameter**
→ Comparability of technologies only for market segments & dependent of other components & financing scheme
 - **No clear winner expected**
→ Most likely a PV market for each of the PV technologies – Question is rather which dominates in long term*

* This again depends on markets and development of other components.





€/KWh Scenario for different Technologies in different market segments

Conceptual scenario for next decade

Technology	Module Price	Roof top small size	Roof top large size	Ground mounted + direct light	Ground mounted + diffuse light	Roof top flexible
	€/Wp	€/KWh	€/KWh	€/KWh	€/KWh	€/KWh
high-eta mono-Si	1,65	0,16	0,14	0,11**	0,12*	
mc-Si	1,50	0,15	0,15	0,11**	0,12*	
TF high-eta	1,40	0,17	0,16	0,10*	0,11*	
TF med.-eta	1,20	0,18	0,16	0,11*	0,11*	
TF flexible	0,80					0,10

CONCEPTUAL

PV market for each PV technology possible

* one-dimensional tracked system
** two-dimensional tracked system



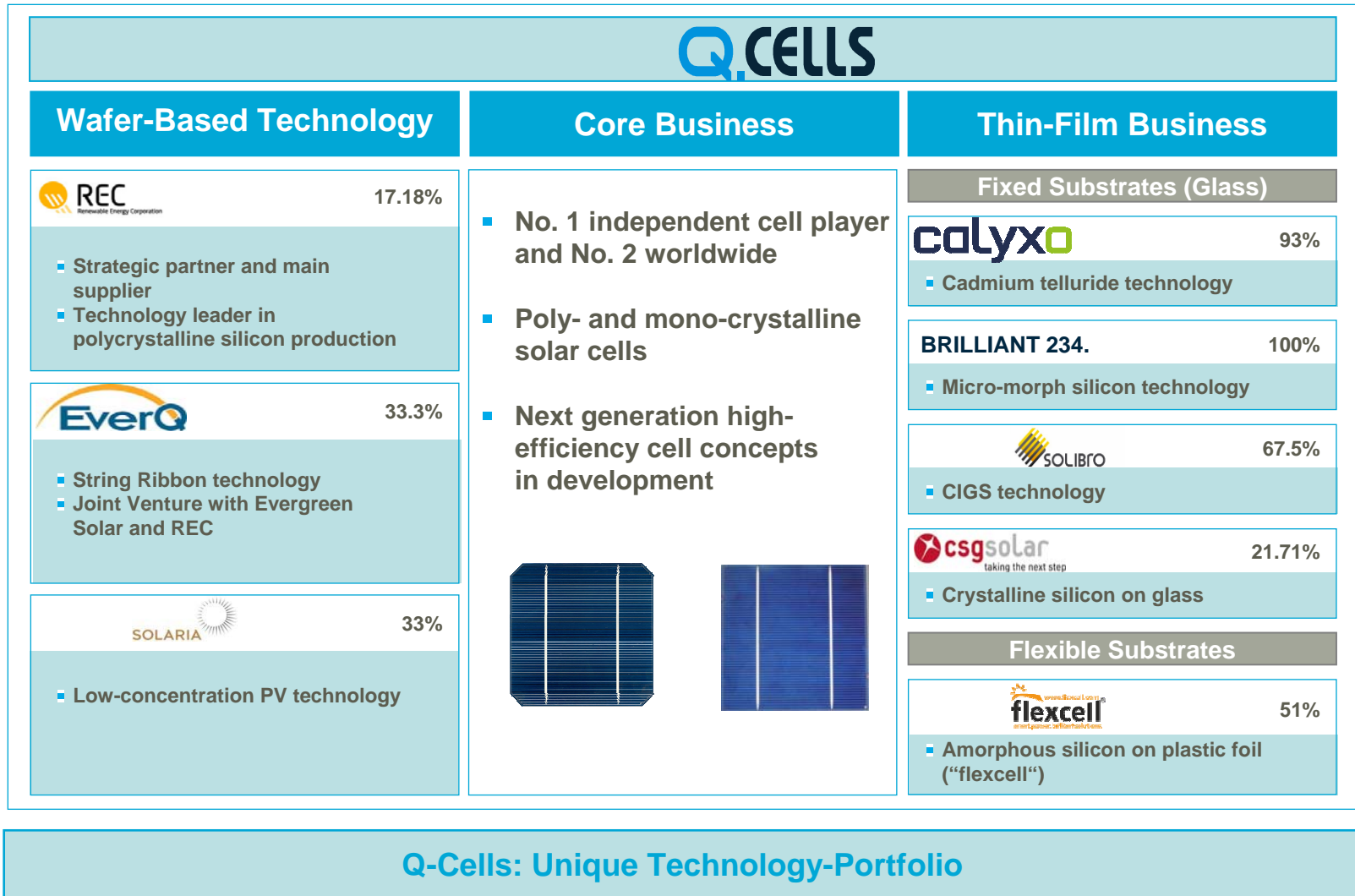


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Group Organisation mirrors portfolio approach





VHF-Technologies – Current Status

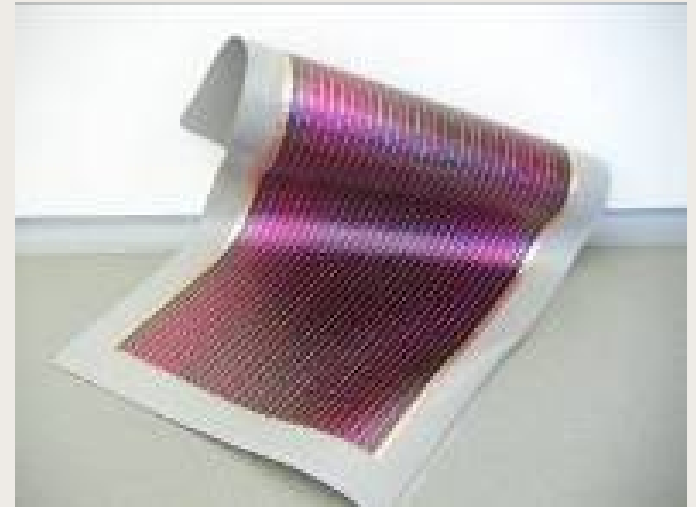


- **Flexible thin-film modules** (amorphous silicon onto plastic substrates)
- “Multi-pass” PECVD
- **Business area:** Consumer products, roof applications and building integrated PV
- **First modules from test line produced and delivered**
- **Construction of next expansion step (25 MWp) started (Switzerland)**
- **Q-Cells´ shareholding: 51%**





- Low weight
- Ramp-up of next line (25 MWp) in H2 2008
- Efficiency: start ~5% (amorphous silicon) going to 8% (micromorph silicon)
- Break-even at ~4.5%
- Employees end of 2008: ~120





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Director Strategic Business Development

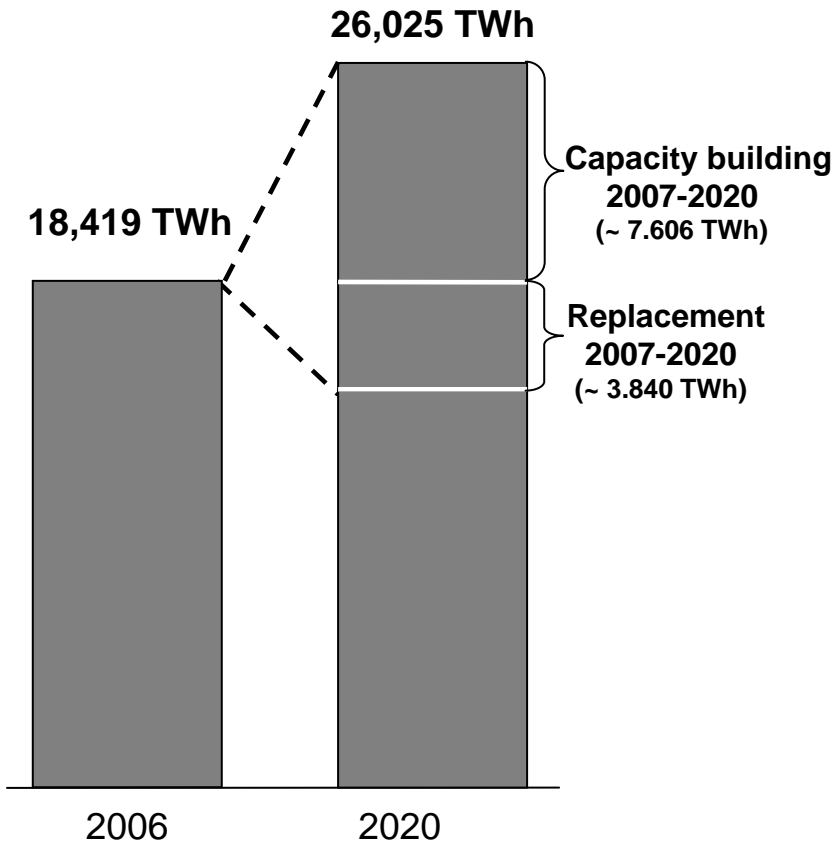
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PV-Ratio of worldwide Electricity Generation in 2020

Electricity generation in TWh*



Key metrics

➔ PV-ratio of total electricity production in 2020

2 - 4%

➔ PV-ratio of electricity production of newly installed and replaced plants between 2007 and 2020

4 - 9%

➔ PV-ratio of electricity production of newly installed and replaced plants in 2020

12 - 34%

*Assumption: growth of electricity production 2.5% p.a., average lifetime of plants 30 years, PV-growth between 30 – 40% p.a. from 2006 starting at 2 GWp



Cost Reduction Potentials at the Cell Level

1 Cell Thickness Reduction

70 μm decrease in thickness leads to approx. 10-15% increase in wafer output or 10-15% cost reduction

2 Higher Cell Efficiency

1% increase in cell efficiency leads to approx. 7% cost reduction at all levels of value chain

3 Economies of Scale

Cost depression due to increase of production

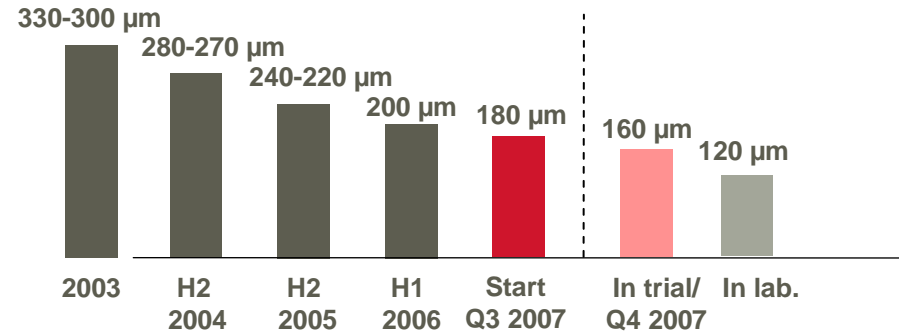
4 Other (cell production)

Increase in throughput, breakage reduction, increasing rate of A-cells, increase in uptimes

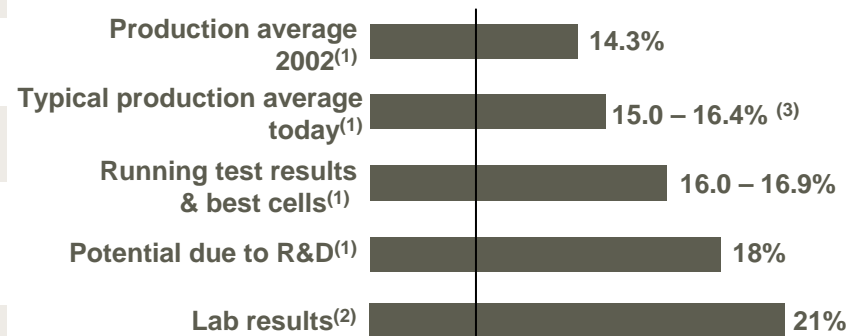
5 In-house Wafering

50 MWp in 2008, >240 MWp in 2009

Cell Thickness Reduction



Cell Efficiency Potential



(1) Polycrystalline cells

(2) Mono-crystalline cells

(3) Process and material dependent

Improvements in technology offer significant cost saving potential