3. Energy Payback Time (EPBT)

- Silicon usage, wafer thickness and kerf loss for c-Si
- EPBT: Development and comparison
c-Si Solar Cell Development
Wafer Thickness [μm] & Silicon Usage [g/Wp]

Historic Trend in Energy Payback Time of Crystalline Silicon PV Modules

Depending on the technology and location of the PV system, the EPBT today ranges from 0.7 to 2 years.

Rooftop PV systems produce net clean electricity for approx. 95% of their lifetime, assuming a life span of 30 years or more.

EPBT of multicrystalline PV rooftop systems installed in Southern Europe*

*Irradiation: 1700 kWh/m²/a at an optimized tilt angle

Energy Pay-Back Time for PV and CPV Systems
Different Technologies located in Catania, Sicily, Italy

Global Irrad.: 1925 kWh/m²/yr, Direct Normal Irrad.: 1794 kWh/m²/yr

Energy Pay-Back Time of Rooftop PV Systems
Different Technologies located in Germany

Global Irrad.: 1000 kWh/m²/yr

Data: M.J. de Wild-Scholten 2013. Graph: PSE AG 2014
Energy Pay-Back Time of Multicrystalline Silicon PV Rooftop Systems - Geographical Comparison

Irradiation (kWh/m²/a)  EPBT

- <600
- 2.1 years
- 1.2 years

Data: M.J. de Wild-Scholten 2013. Image: JRC European Commision. Graph: PSE AG 2014 (Modified scale with updated data from PSE AG and FraunhoferISE)
5. Price Development

- Electricity costs
- Costs for rooftop systems
- Market incentives in Germany
- Price Learning Curve
Electricity Costs and Feed-In Tariffs (FIT) in Germany

Investment for Small Rooftop PV Systems in Relation to Market Development and Subsidy Schemes in Germany

Data: BSW-Solar, BNA. Graph: PSE AG 2016
Average Price for PV Rooftop Systems in Germany
(10kWp - 100kWp)

Data: BSW-Solar. Graph: PSE AG 2016
Price Learning Curve
Includes all Commercially Available PV Technologies

Learning Rate:
Each time the cumulative production doubled, the price went down by 23% for the last 35 years.

Data: from 1980 to 2010 estimation from different sources: Strategies Unlimited, Navigant Consulting, EUPD, pvXchange; from 2011 to 2015: IHS. Graph: PSE AG 2016

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Price Learning Curve by Technology
Cumulative Production up to Q4. 2015

Estimated cumulative production up to Q4, 2015:
- c-Si: 235 GWp
- Thin Film: 24 GWp

Crystalline Technology
(from Q2-2006 to Q4-2015) LR 28.2
Thin Film Technology
(from Q2-2006 to Q4-2015) LR 25.2

Data: from 2006 to 2010 estimation from different sources: Navigant Consulting, EUPD, pvXchange; from 2011 to 2015: IHS. Graph: PSE AG 2016