

PolyOne

7th Arabcab conference

Alternative Energy- The Solar Power



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PolyOne
Sustainable
Solutions



Solar Energy

- ☞ Climate is changing
- ☞ Energy needs are rising
- ☞ Natural resources are decreasing
- ☞ Need to secure alternative energy sources
- ☞ Renewable energy provides an answer





Solar Energy: Limitations

- ⇒ Still an expensive process
- ⇒ Decrease of government subsidies in some countries
- ⇒ Energy production is lower than other types
- ⇒ Energy is produced only if sun is shining





Solar Energy: Advantages

- ⇒ Long operating life time after installation (25 years)
- ⇒ Low maintenance cost (system is static, easy to access)
- ⇒ No pollution when operating: no fuel emission, no noise
- ⇒ Small & kits systems: quick to install
- ⇒ Locally placed, easy to access



Market Overview: Solar

⇒ Solar power generation

⇒ **Photovoltaic power:**

- ✓ Photovoltaic cells are almost always arranged on a panel to form a solar module. Modules are then linked in series to form what is known as a solar array.
- ✓ Modules typically lasting 25 to 40 years

⇒ **Solar thermal power:**

- ✓ Sunlight can be converted indirectly into electricity using concentrating solar power (CSP), which normally focuses the sun's energy to boil water which is then used to provide power.

⇒ Solar heat utilization

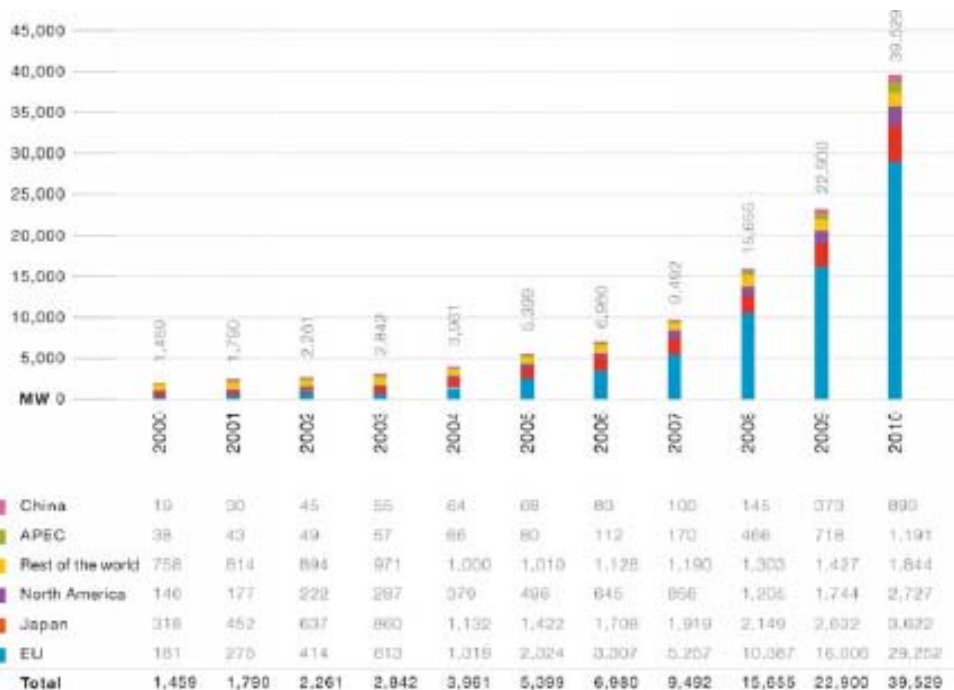
- ⇒ **Solar water heater:** solar collector specifically intended to collect heat: that is, to absorb sunlight to provide heat.





Market Demand: Solar

- ⇒ End market growing at 44% CAGR since 2005 and is projected to grow at 35% CAGR to 2014
 - ⇒ Europe still dominates world market



Evolution of global cumulative installed capacity - 2000-2010

source: EPIA

Source: European Photovoltaic Industry Association, Global Market Outlook for Photovoltaics until 2015, 2011

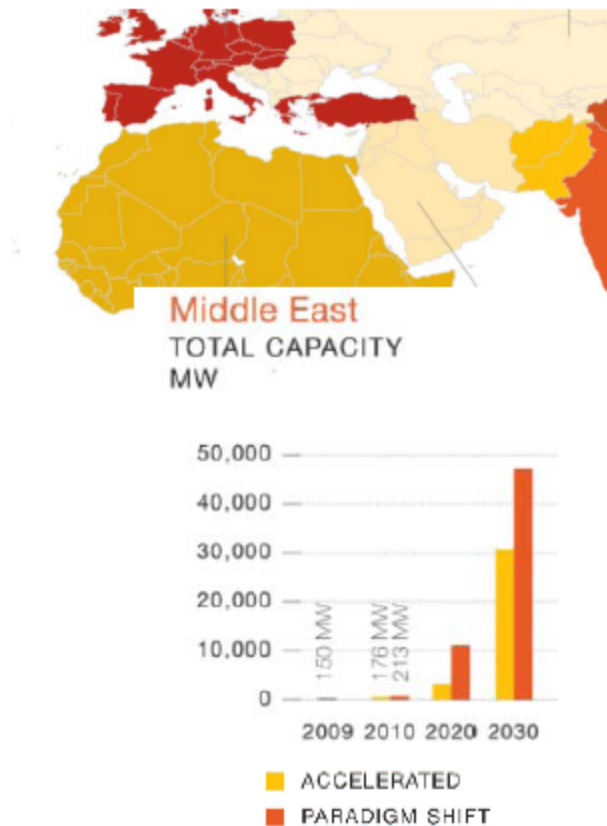
Market Demand: Solar

⇒ Middle East potential

- ⇒ One of the highest concentrations of sunlight worldwide
 - ✓ Average annual direct normal irradiance per day: Europe 2-3 kWh/m², GCC 6-8 kWh/m²
 - ✓ Hours sunshine per year – Germany 600, GCC 3000
 - ✓ The average energy received: Europe 1,200kWh/m² per year, compared with 1,800 to 2,300kWh/m² per year in Middle East

⇒ High demand growth for power

- ✓ Will require 100GW of additional power over next 10 years
- ✓ Opportunities of up to 11GW potential PV installation by 2020 and 47GW by 2030



Source: European Photovoltaic Industry Association - Greenpeace International, Solar Generation VI, 2011



Environmental Concerns & OEM Policies

- ⇒ **The ongoing desire for environmentally friendly materials reinforced by legal regulations**
 - ⇒ Continue to drive developments in the wire & cable industry.
 - ⇒ The cables need to be integrated into a sustainable energy supply system
 - ⇒ This has driven the need for non-halogenated & LSFOH flame retardants

- ⇒ **OEM Policies**
 - ⇒ A number of the leading electronics manufacturers are looking to reduce use of halogen compounds
 - ⇒ High level of safety is of high concern for OEMs





OEM Specific Requirements on wires

- ⇒ Resistant to harsh environments : ozone, alkali, acid, water etc.
- ⇒ Weather resistance
- ⇒ Temperature resistant: from cold to high rating
- ⇒ Long term electrical performance: cables must resist up to 6.5kV AC in water
- ⇒ Fire safety: low toxicity, low smoke emission, low corrosivity, resistant to fire as integrated into sustainable system
- ⇒ Easy installation: flexibility of cable needed as well as good resistance to scratch & notch
- ⇒ Long component life (>>25years)





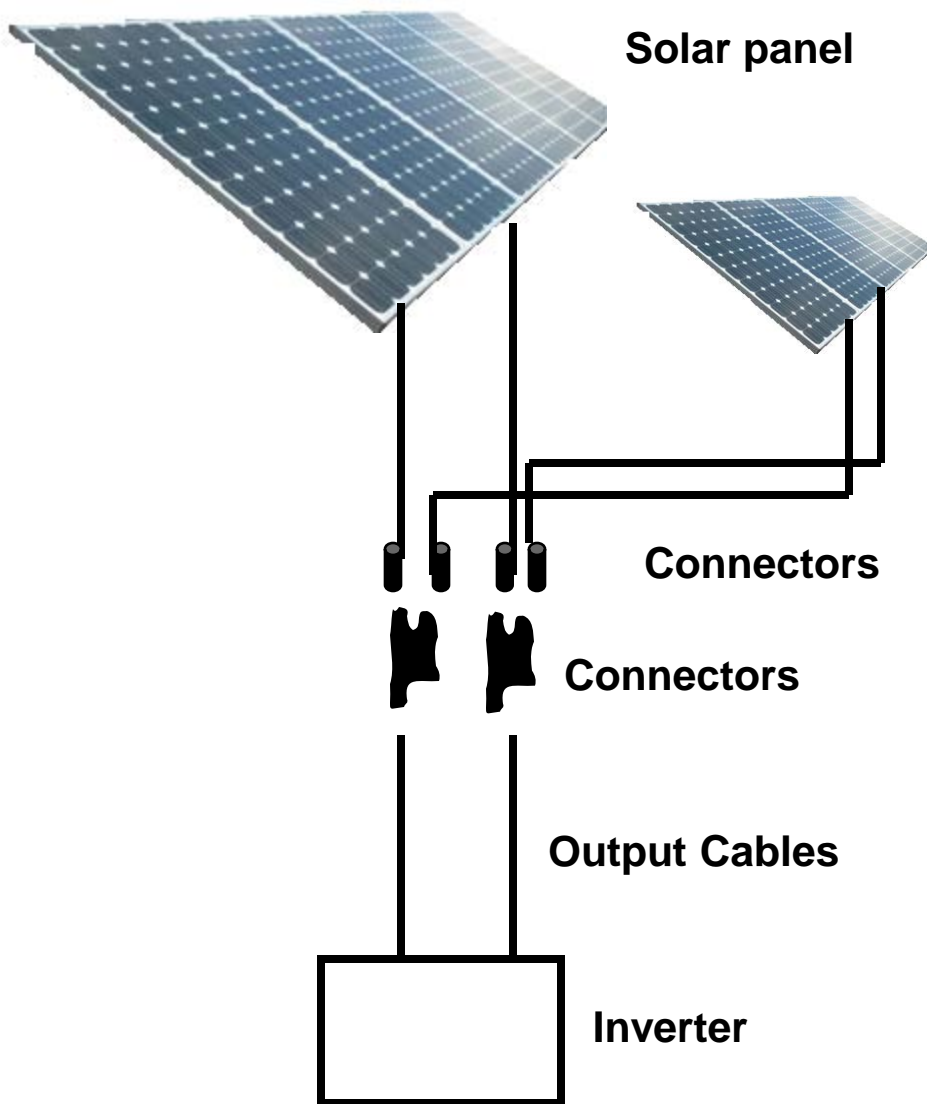
Cable manufacturer specific requirements

- ⇒ Fulfill OEMs requirements
- ⇒ Meets specifications
- ⇒ Continuous cable extrusion process
- ⇒ Easy to process
- ⇒ High speed extrusion
- ⇒ Standard extruder usage
- ⇒ Cables with consistent properties & high quality standard

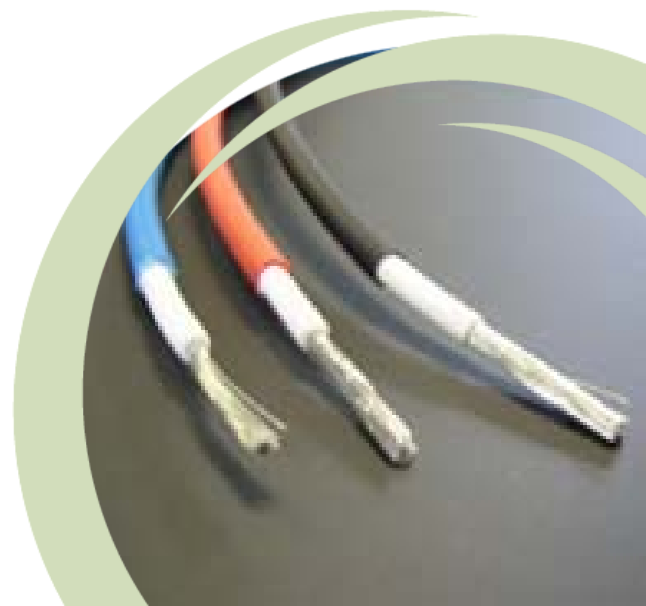




Photovoltaic System



➔ From modules to cabling through connectors & distribution: a safe solution



Legislation & global trends

- ⇒ Besides the NEC 690.31, countries develop their own specification
- ⇒ Target is to ensure high & consistent performance of photovoltaic panels
- ⇒ Also material choice needs to be integrated into sustainable system

- ⇒ Two main Groups
 - ⇒ *TÜV 2 Pfg 1169/08.2007 applied in Germany*
 - ✓ *Japan* *JCS 4517:2010*
 - ✓ *France UTE C 32-502*
 - ⇒ *UL 4703 applied in North America*
 - ✓ *Canada* *CSA*
 - ⇒ *Others:*
 - ✓ *Spain EA3008, Italy: IMQ, Etc.*





Photovoltaic - PolyOne Solutions

☞ UL 4703

☞ Main challenges are:

- ☞ LTWIR: insulation resistance at 90°C in water bath, min 12 weeks
- ☞ UL1581-UL2556 Vertical Flame test: VFT1 (VW1 optional)
- ☞ High mechanical properties (min 160%)

PolyOne offering:

- ☞ ECCOH™ SOLAR U 5946 for insulation
- ☞ ECCOH™ SOLAR U 5947 for sheathing

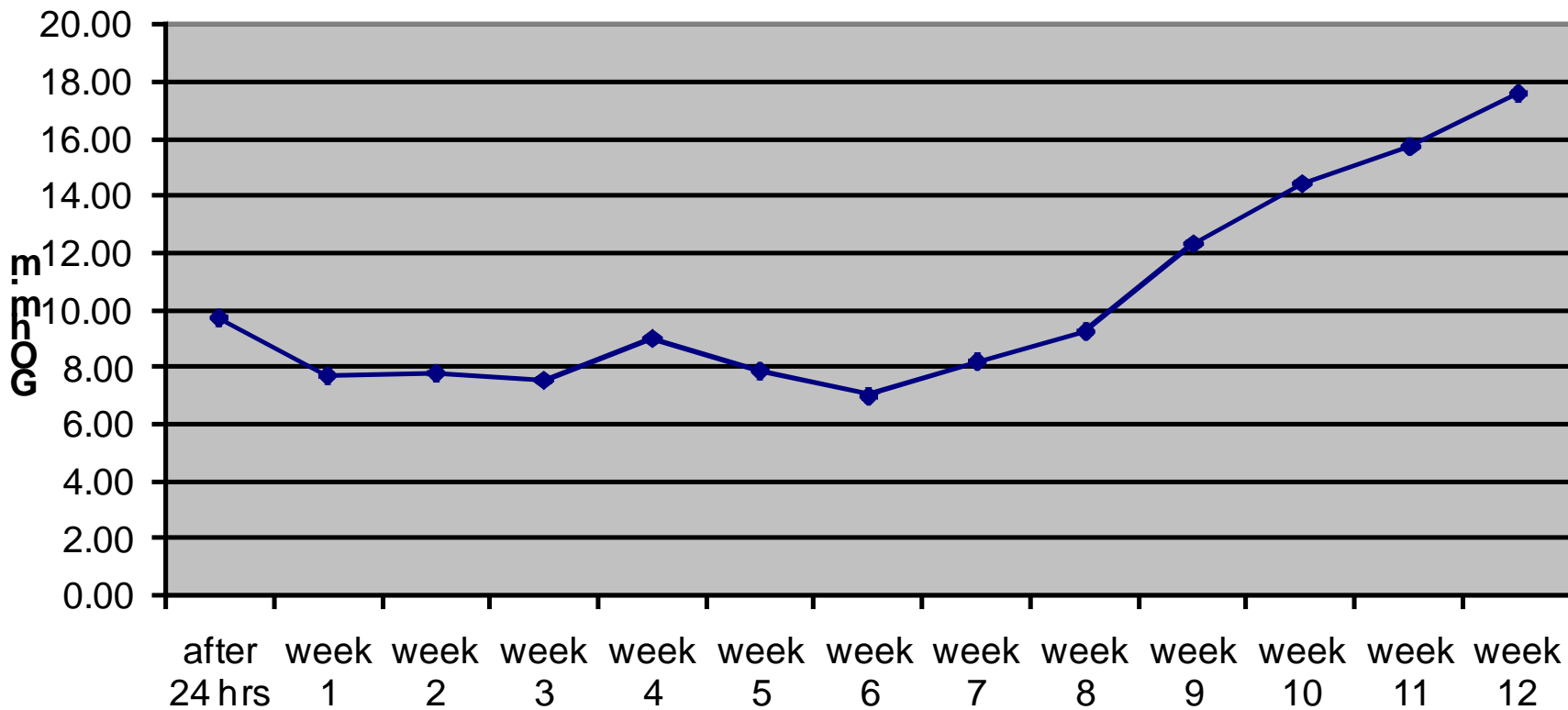
This solution is available under E-beam or silane moisture curing system to meet VFT1 flame test





Photovoltaic - PolyOne Solutions UL

LTWIR 90°C ECCOH Solar U 5946 natural, crosslinked, 45mils



UL requirement

LTWIR > 0.075 GOhm.m

time



Photovoltaic - PolyOne Solutions

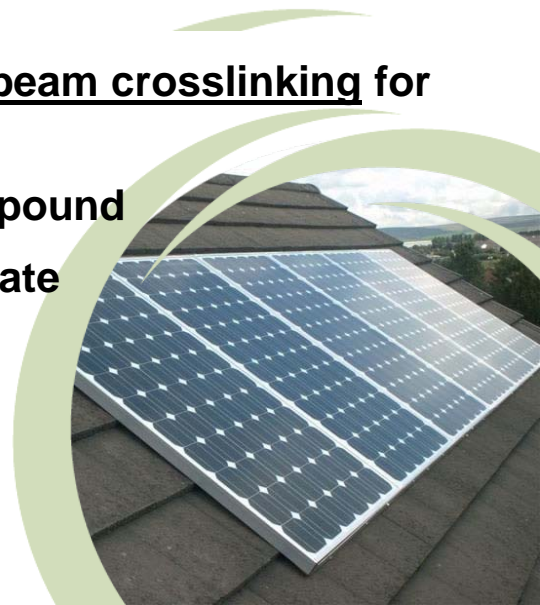
- ⇒ TÜV 2 pfg1169.08.2007
- ⇒ **Main challenges are to allow DC1.5kV for 25years...**
 - ⇒ Thermal ageing: 20000h at 120°C
 - ⇒ Damp heat resistance 1000h 85°C in humid environment
 - ⇒ Halogen free flame retardant
 - ⇒ Electrical insulation resistance in water at 20°C
 - ⇒ Electrical insulation resistance at 90°C
 - ⇒ Dynamic penetration test





Photovoltaic - PolyOne Solutions

- ⊃ Two systems depending on your crosslinking technology to meet TÜV:
- ⊃ PolyOne™ SOLAR-T wire and cable system using silane crosslinking for your wires for both insulation & sheathing
 - ⊃ ECCOH™ SOLAR-T wire and cable LSFOH compound
 - ⊃ OnCap™ SOLAR Dry Silane wire and cable concentrate
 - ⊃ OnColor™ SOLAR wire and cable black color concentrate
 - ⊃ SmartBatch™ SOLAR wire and cable red or blue color with UV additive concentrate
- ⊃ PolyOne™ SOLAR-Tebeam wire and cable system using E-beam crosslinking for your wires for both insulation & sheathing
 - ⊃ ECCOH™ SOLAR-T ebeam wire and cable LSFOH compound
 - ⊃ OnColor™ SOLAR wire and cable black color concentrate
 - ⊃ SmartBatch™ SOLAR wire and cable red or blue color with UV additive concentrate



Photovoltaic - PolyOne Solutions

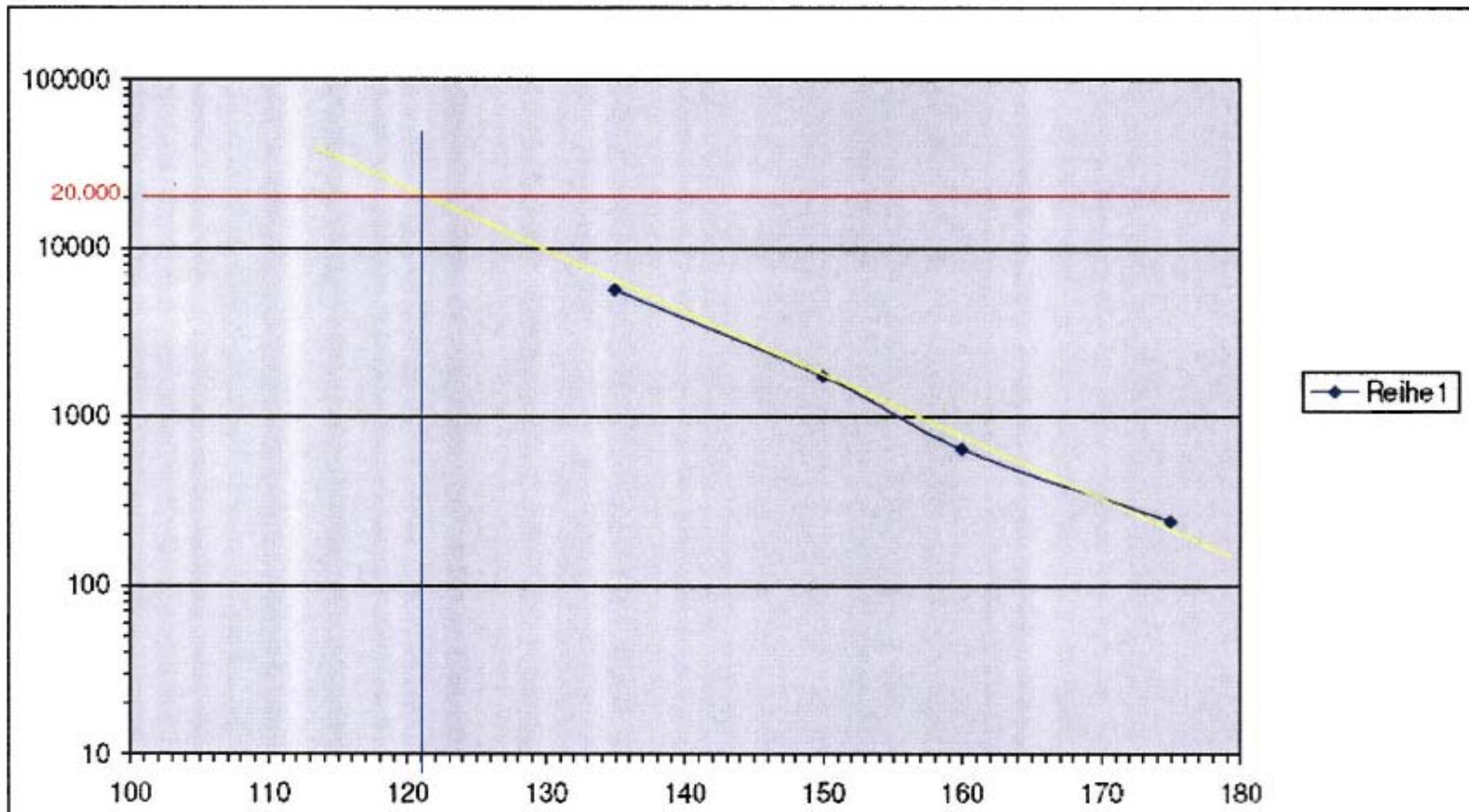
Long term ageing according to IEC 60216-1 on 0.7mm cable*

135	5616
150	1732
160	648
175	240

Temperatur	Zeit
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Graphische Darstellung der Arrheniuskurve für Leitung

Bei 20.000h beträgt die Höchsttemperatur an der Leitung 121 °C



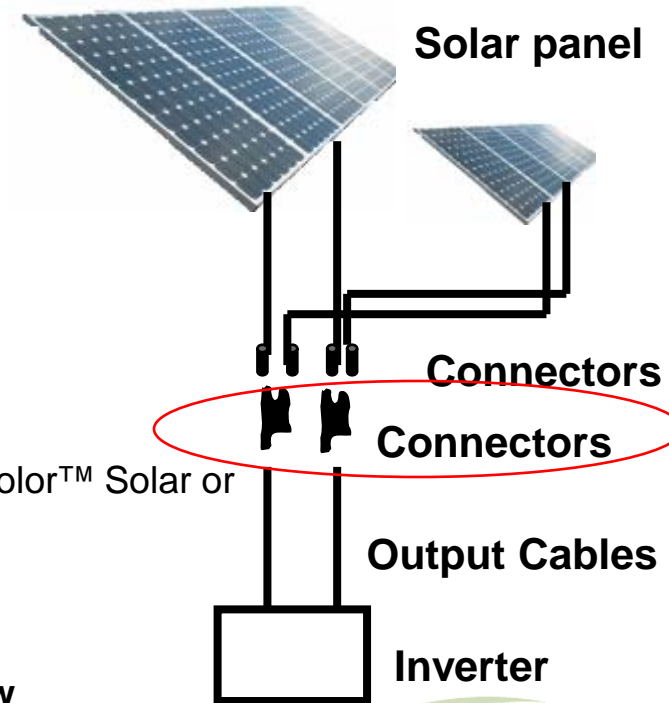
Photovoltaic over-molded connectors

⇒ Application:

- ⇒ Photovoltaic over-molded connectors

⇒ Solution:

- ⇒ PolyOne™ advanced development ECCOH™PF 1077
- ⇒ Excellent processing in injection moulding
- ⇒ Same technology as PolyOne™ Solar systems:
ECCOH™ compound + Oncap™ Solar dry Silane + Oncolor™ Solar or Smartbatch™ Solar concentrates
- ⇒ Comprehensive solution with several benefits:
 - ✓ Fire safety: halogen free flame retardant with low toxicity, low smoke emission, and low corrosivity
 - ✓ Provides excellent adhesion on cables





Electrical Components

⇒ Application:

- ⇒ Electrical components: interconnection switches, fuse holders and functional parts for DC & AC disconnectors

⇒ Solution:

- ⇒ Halogen Free Flame Retardant (HFFR) engineered materials: Bergamid™ PA, Bergadur™ PBT, Maxxam™ PP and Edgetek™ AM High Temperature PA compounds
 - ✓ Comply with the IEC 60364-7-712 international standard for solar photovoltaic electrical components
 - ✓ RoHS directive compliance
 - ✓ Excellent electrical properties (CTI 600V)
 - ✓ High temperature & creep resistance (HTD>260°C)
 - ✓ Dimensional stability
 - ✓ Glow wire resistance (960°C/0.8mm) and flammability (V0/0.8mm) with UL94 recognition
 - ✓ Low moisture sensitivity, with chemical and environmental resistance





NEXT?

What about anti-rodent?

→ **Sustainable Rodrepel™**

What about anti-termite?

→ **Sustainable Termirepel™**

What about system supporting the panel?

→ **Long Fiber Thermoplastic polyolefins opportunities**



THANK YOU !

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