EcoPaXX™

EcoPaXX the green performer

DSM Engineering Plastics, R&T
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Netzwerktreffen BIOPRO Baden-Württemberg GmbH
Stuttgart, July 13, 2011

EcoPaXX™

DSM Engineering Plastics

- Leading global supplier of quality engineering thermoplastics
- Located in Jiangyin, Pune, Seoul, Singapore, Taipei, Genk, Emmen, Geleen, Sittard, Shanghai, Tokyo, Kuala Lumpur, Shenzhen, Jiangsu, Evansville, Beijing, Detroit, Augusta
- Sales in 2010 € 1,045 million and about 1600 employees worldwide
- DSM Engineering Plastics is ISO 9001, ISO/TS 16949 and ISO 14001 certified

Akulon® Novamid™ Stanyl® Stanyl® ForTii™ EcoPaXX™ Arnitel® Arnite®

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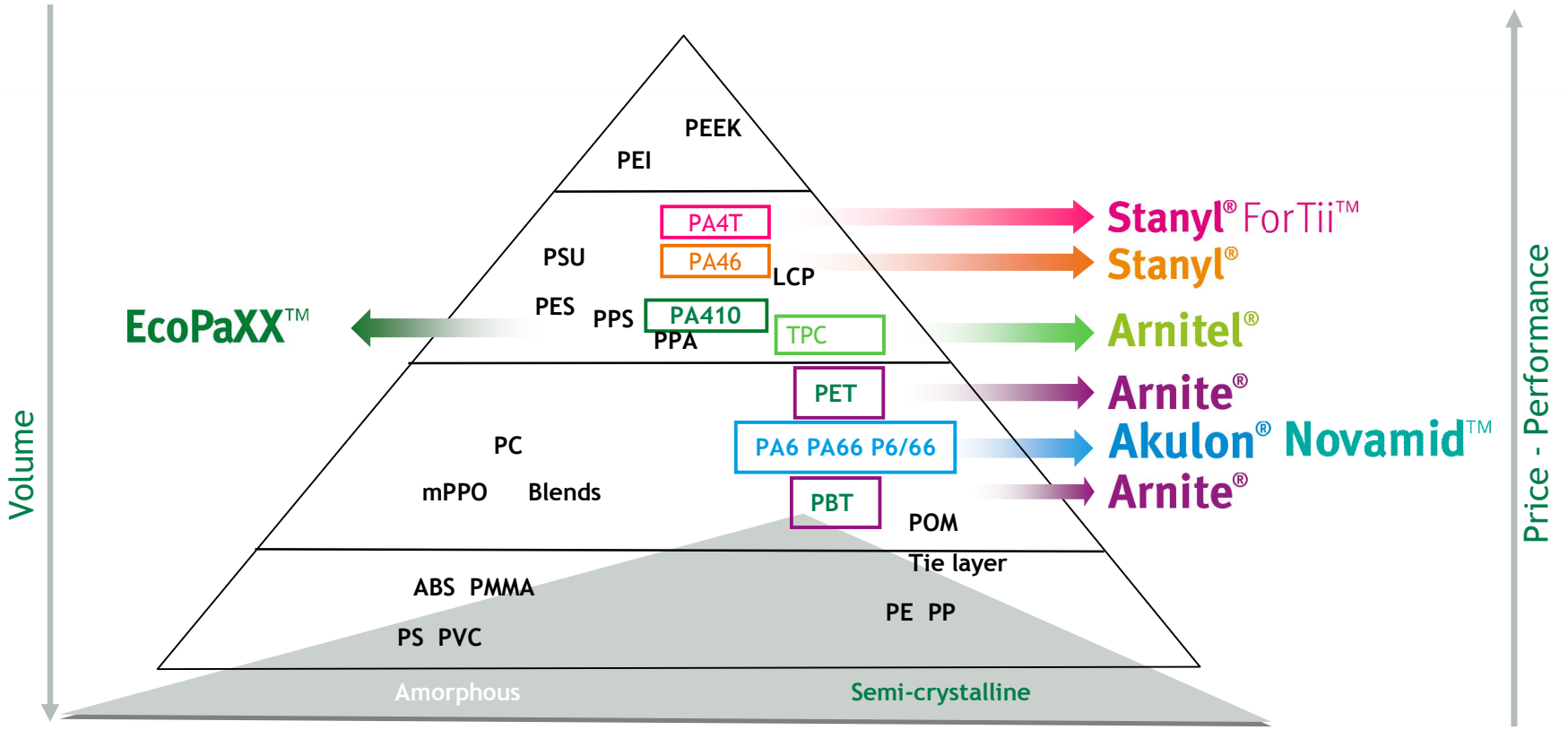
EcoPaXX™

Leadership in core product lines



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Sustainability our core value

External recognition

- Clear sustainability targets in Vision 2010
- Top position in Dow Jones Sustainability Index
- A+ rating for Triple P report
- Continuous improvement of eco-footprint
- Global partner of UN World Food Program

Sustainability strategy

The quest for sustainable development will be the main trend for the future.

Differentiators today will become qualifiers in all major EP markets;

- Low or neutral carbon footprint of materials and applications
- Elimination of hazardous substances
- Recycling with the ultimate goal to reach cradle to cradle solutions
- Bio-based polymers able to perform in critical technical components

Our aim is to create sustainable growth via our ECO+ solutions;
products and services that create more value with less environmental impact.

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Why EcoPaXX ?

- **Because we believe in sustainable materials that are durable and have a low impact on our environment**

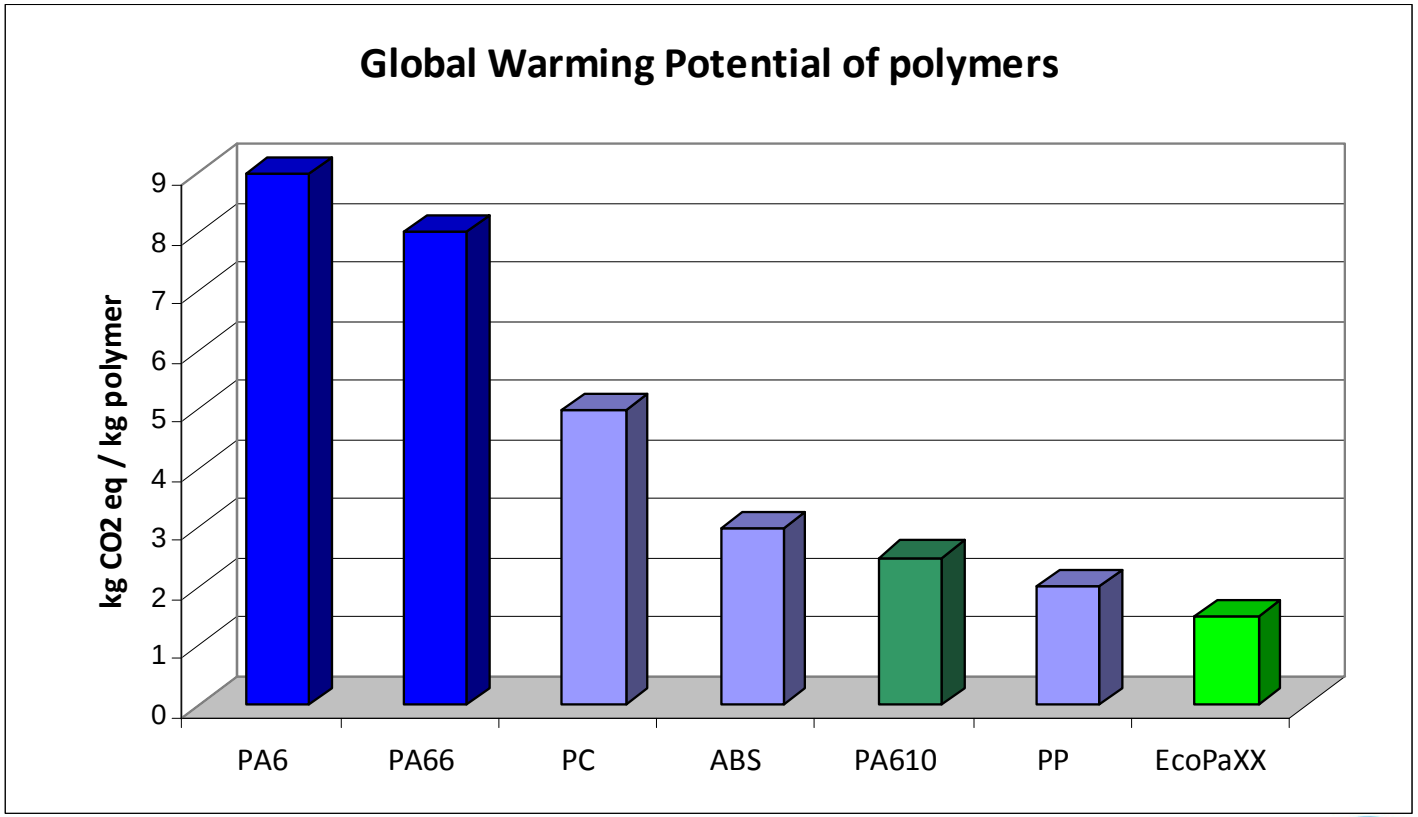
- **Because EcoPaXX has excellent properties: it combines the best of high melting and hydrophobic polyamides:**
  - Excellent mechanical properties
  - High melting point of 248 °C → **high heat stability**
  - Excellent thermal stability → **broad processing window**
  - Low moisture absorption
  - High stiffness retention after conditioning
  - Good hydrolytic and chemical resistance
  - Relatively low density → weight reduction

"Combining unique DSM knowledge with the skills of Mother Nature allows our Customers to benefit from a new step towards a more sustainable world" says Roelof Westerbeek, President of DSM Engineering Plastics

EcoPaXX: carbon neutral

CO_2 generated in production process is compensated by absorption in growth process of the renewable resource

Method: IPPC 2001 GWP 100a V1.02 / characterization



External validations done for EcoPaXX™ by PE Int. and EPEA:
LCA: ISO14044, C-footprint: PAS2050, Cradle-to-Cradle (Silver cert.), EPD introduction

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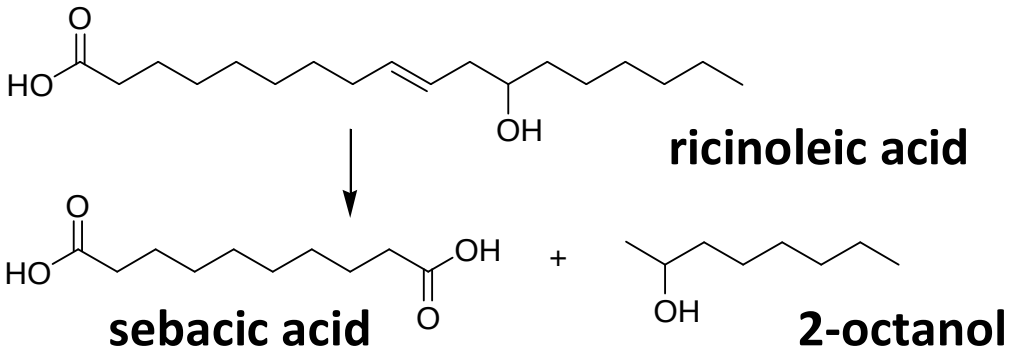
EcoPaXX: bio-monomer

- Castor oil derived from Ricinus Communis
- Non-edible (no competition with food-chain)
- Easily grows on poor soils in: India, China, Brazil etc.
- beans contain ~ 45% castor oil
- ~85% of oil is ricinoleic acid

- Farm – trader – pressing – chemical plant
- overall yield from bean to sebacic acid ~ 30%



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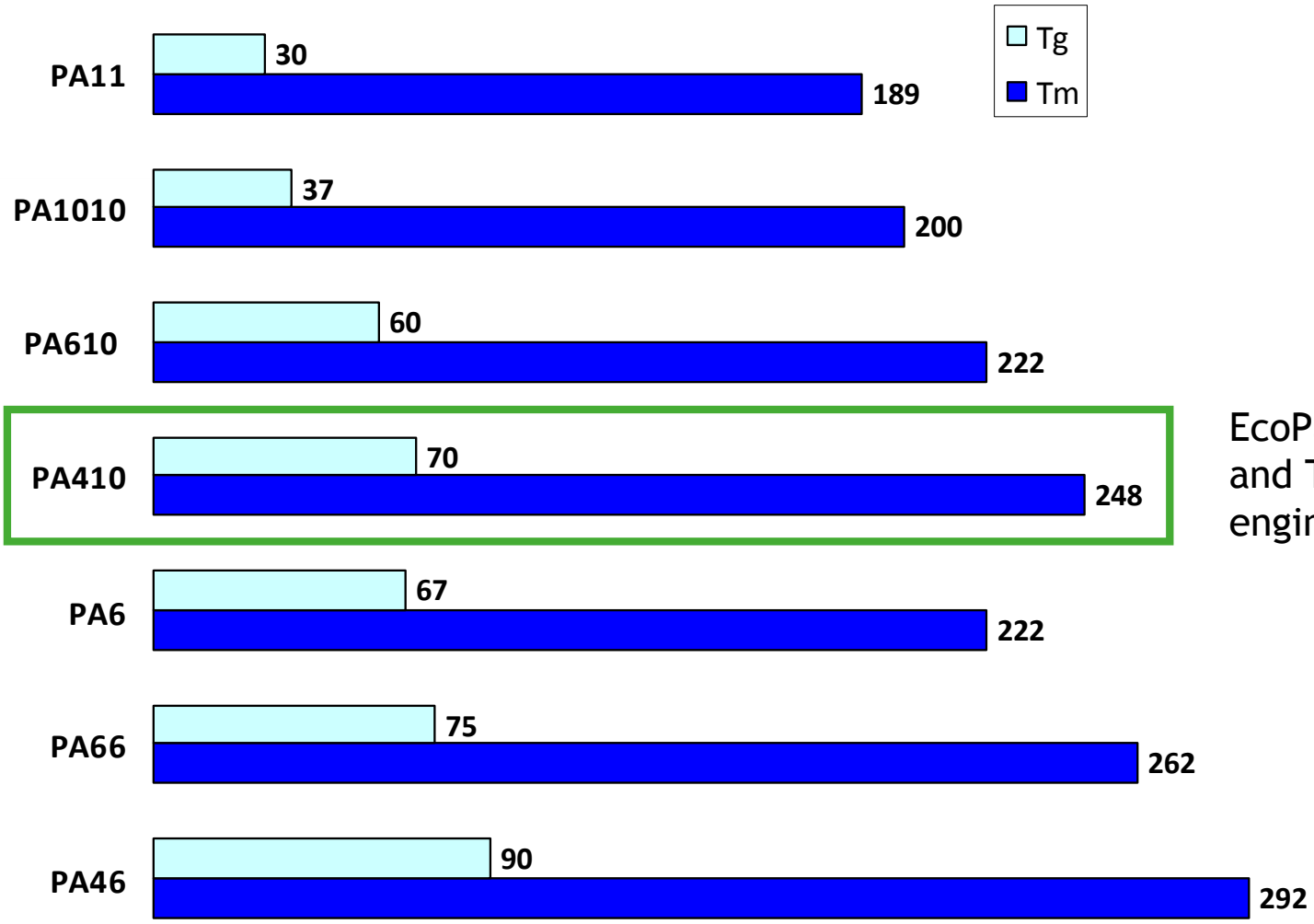
EcoPaXX: base polymer, T_g & T_m



EcoPaXX has highest Tm and Tg of all bio-based engineering plastics!

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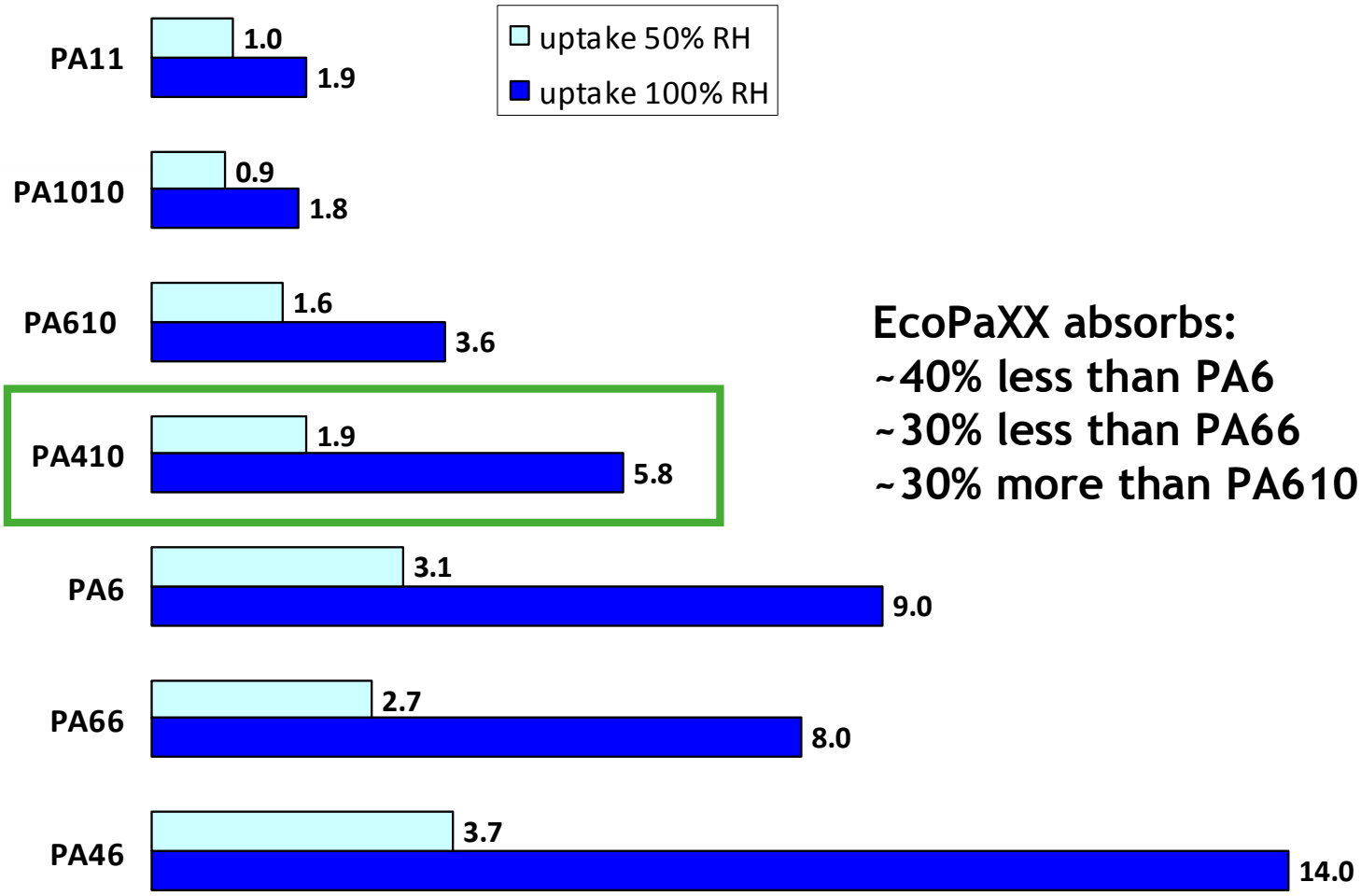
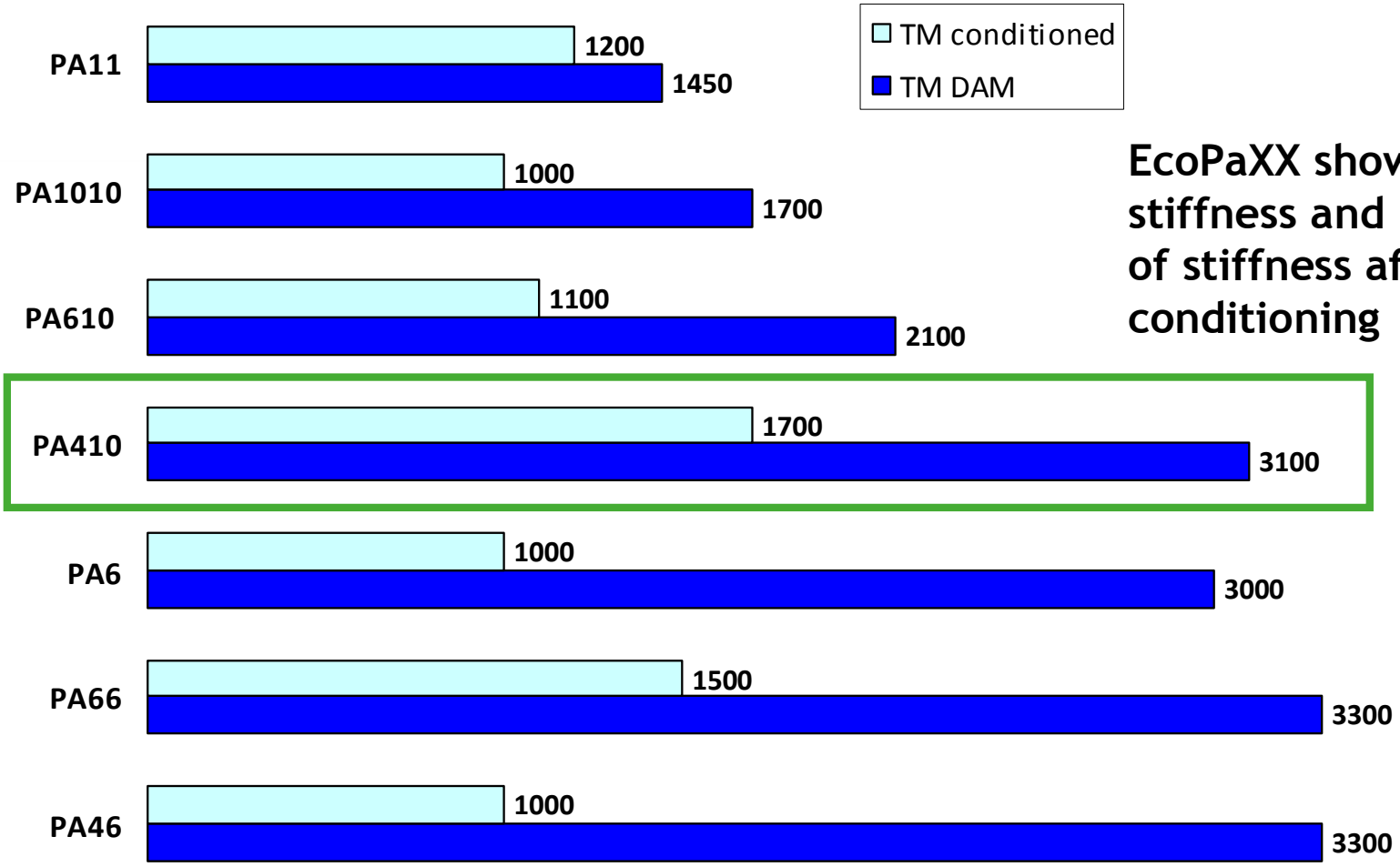
EcoPaXX: base polymer, water uptake



EcoPaXX absorbs:
~40% less than PA6
~30% less than PA66
~30% more than PA610

EcoPaXX: base polymer, mechanical



EcoPaXX shows high stiffness and retention of stiffness after conditioning

EcoPaXX: product portfolio

Launch of 5 grades at K2010 Düsseldorf

- **Q150-D: unfilled, nucleated**
- **Q-HG6: 30% glass-fiber, multi-purpose**
- **Q-HG10: 50% glass-fiber, high stiffness**
- **Q-HGM24: hybrid (glass-fiber & mineral), automotive**
- **Q-KGS6: 30% glass-fiber, halogen-free flame-retarded, E&E**

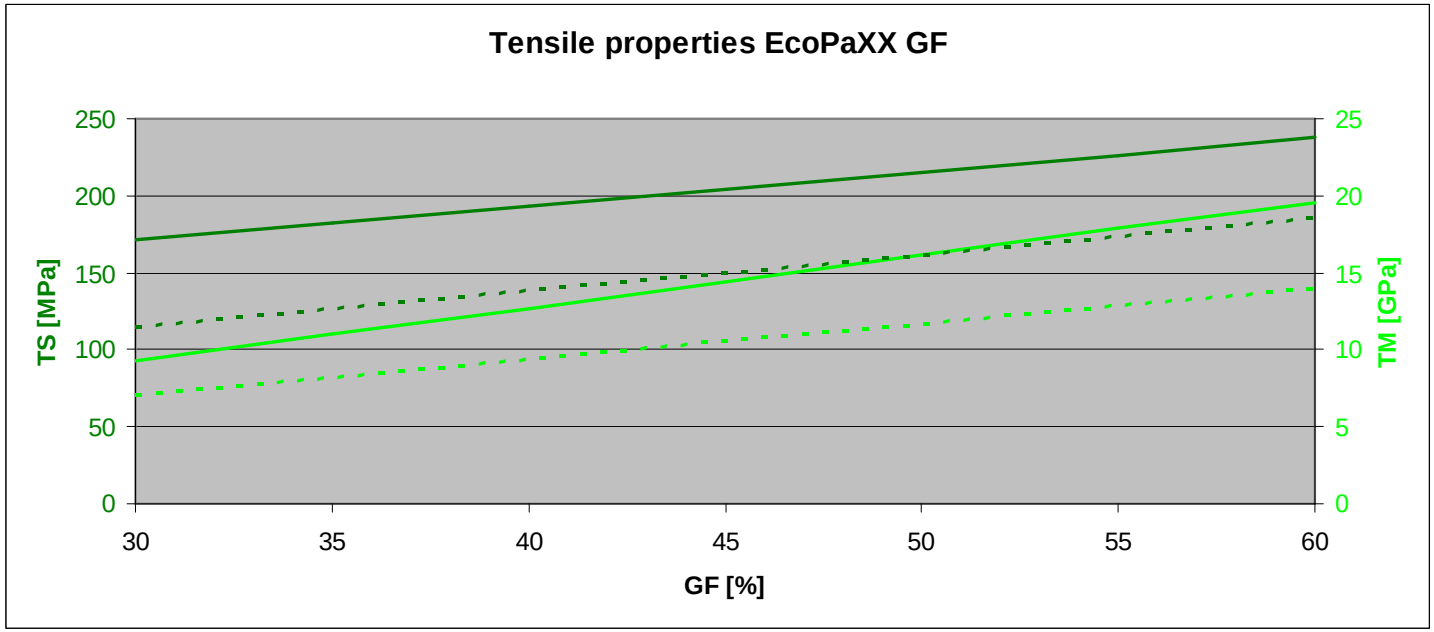
- **Q-P4: unfilled, impact-modified**
- **Q-PG6: 30% glass-fiber, impact-modified**
- **Q-PG8: 40% glass-fiber, impact-modified**

Q-HG6, Q-HG10, Q-HGM24 available on > 1000 kg scale
Q150-D, Q-KGS6, Q-P4, Q-PG6 & Q-PG8 available as samples

EcoPaXX: GF-reinforced

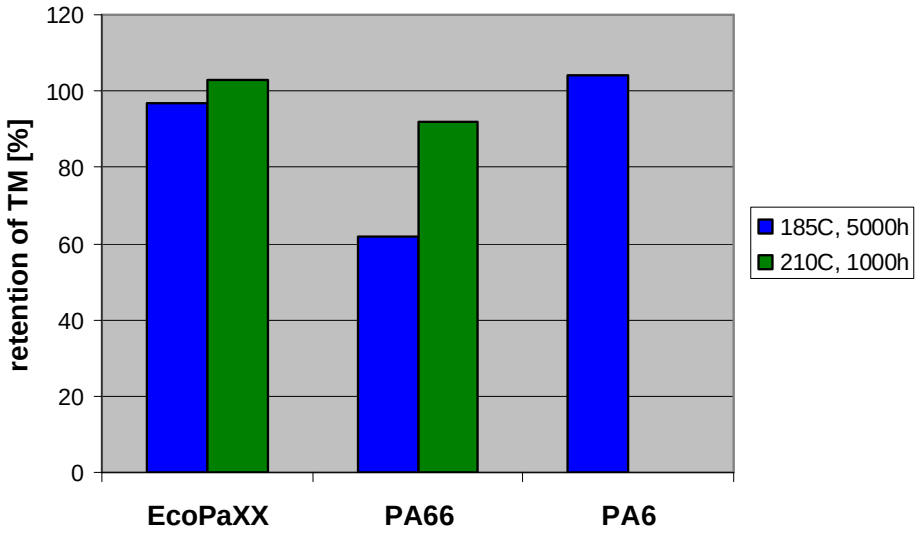
Why EcoPaXX GF grade?

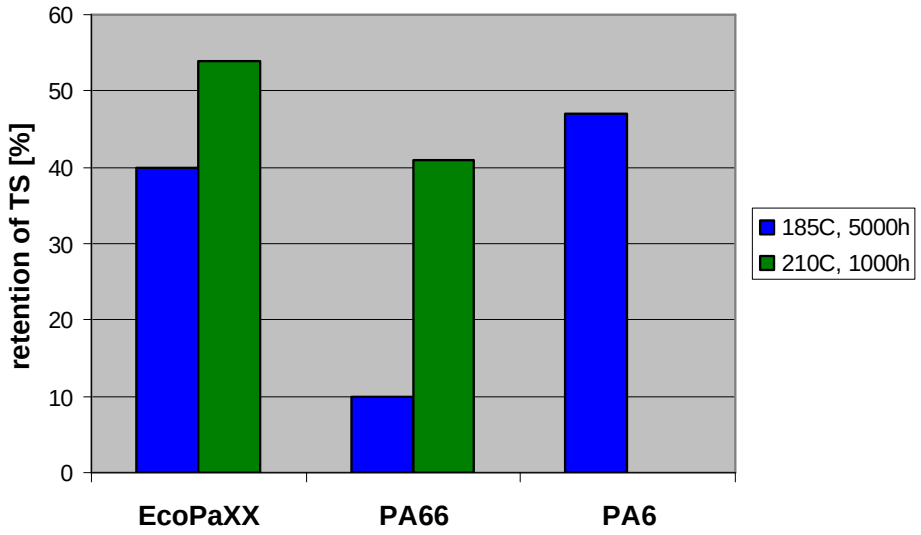
- higher mechanical properties than unfilled grades
- high performance at very low carbon footprint
- good combination of chemical resistance and mechanical properties
- excellent flow



- Stiffness up to 20 GPa, strength up to 240 MPa while elongation still 2.5% !
- After conditioning: stiffness up to 14 GPa, strength 190 MPa and elongation 3.2%

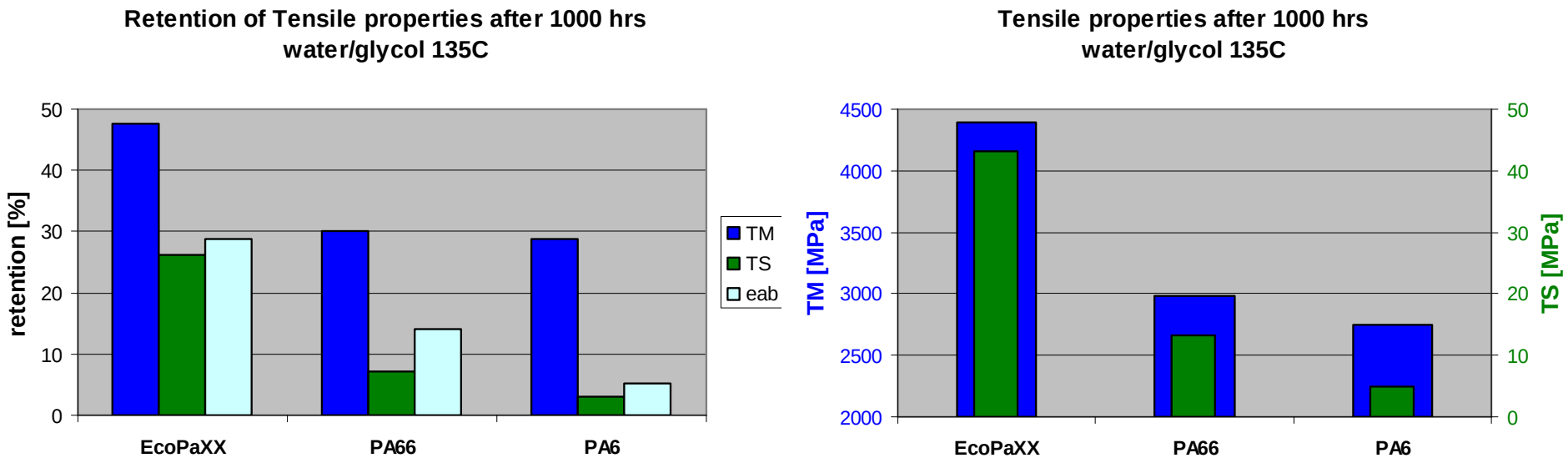
EcoPaXX: GF-reinforced, heat resistance





- EcoPaXX shows similar heat ageing as PA6
- EcoPaXX shows excellent retention of stiffness and strength compared to PA66 upon heat ageing up to 210!

EcoPaXX: GF-reinforced, hydrol. resistance



- due to low water uptake and high resistance to hydrolysis, EcoPaXX displays superior retention of all tensile properties
- while PA66 and PA6 display tensile properties of unfilled material, EcoPaXX still shows glass-filled level properties
- **Overall, hydrolytic resistance of EcoPaXX significantly better than PA6 and PA66: low water uptake and low degree of hydrolysis ensure high level of relative AND absolute mechanical properties after 1000 hrs of exposure to 135 C water/glycol mixture**

EcoPaXX: technical conclusions

Compared to PA6, EcoPaXX offers:

- an ECO^{++} solution
- comparable or better mechanical properties
- superior chemical resistance

Compared to PA66, EcoPaXX offers:

- an ECO^{++} solution
- comparable mechanical properties
- higher heat ageing stability
- higher chemical resistance

Compared to PA610, EcoPaXX offers:

- an ECO^{+} solution
- Better (thermo)mechanical properties
- comparable chemical resistance

EcoPaXX: conclusions

Bio-based Polymer EcoPaXX

Trends:	Need for bio-based polymers for high performance solutions with better footprint and reduced fossil fuel dependency
Application:	Consumer electronics Sports & leisure Automotive UTB
Features:	Bio-based High dimensional stability Hydrolytic resistance
Eco+:	Chemical resistance against oil, grease, salts 100% carbon neutral from cradle-to-gate

CERTIFIED CM
cradle to cradle
SILVER

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