



victrex

Metal Replacement with VICTREX PEEK Guide



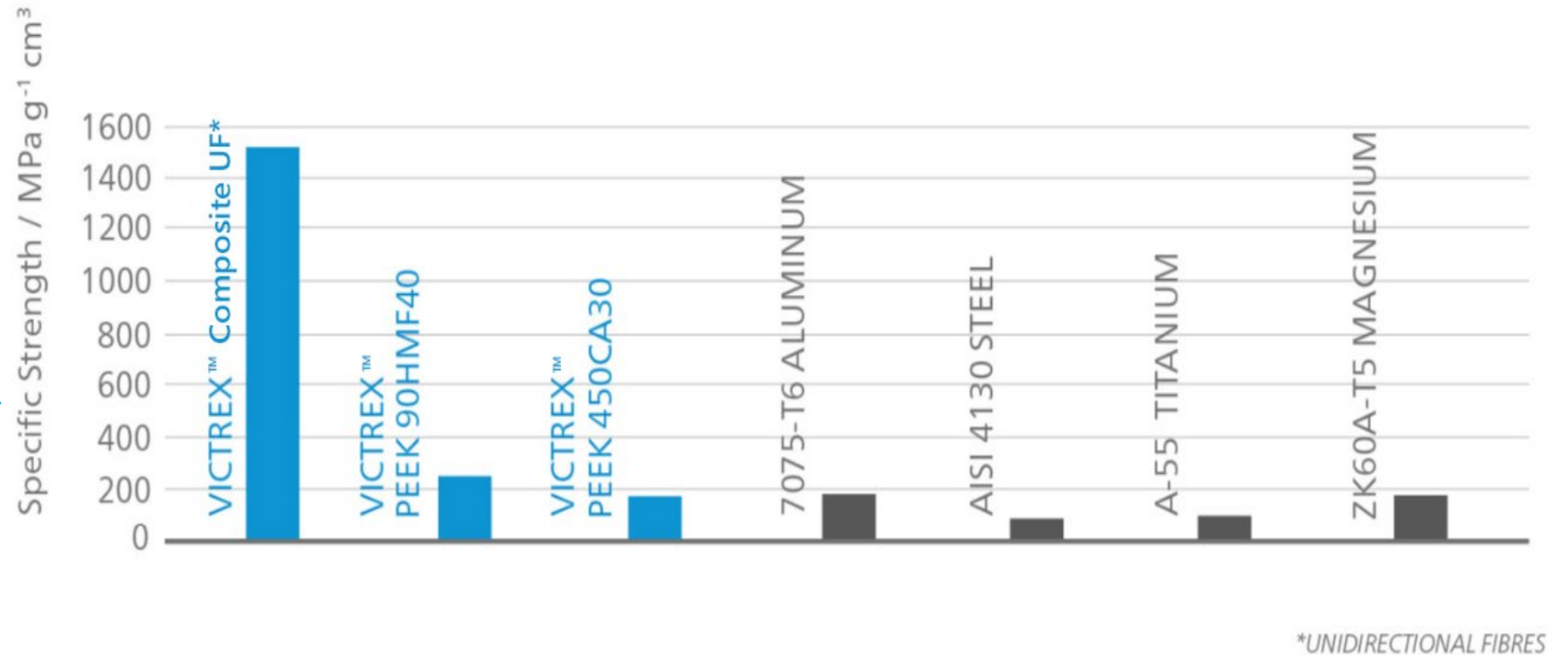
WHY REPLACE METALS?

“Global manufacturing trends towards **miniaturisation, demanding operational environments, higher performance, and lighter components** means replacement of metals by High Performance Polymers such as PEEK, will accelerate”

Professor John Grasmeder, Victrex Chief Scientist

WHY REPLACE METALS?

SPECIFIC STRENGTH COMPARISON **



VICTREX™ PEEK

Tailor properties in 3 dimensions with increased design freedom whilst saving weight & material

METAL

VICTREX™ PAEK FIBRE REINFORCED COMPOSITES*

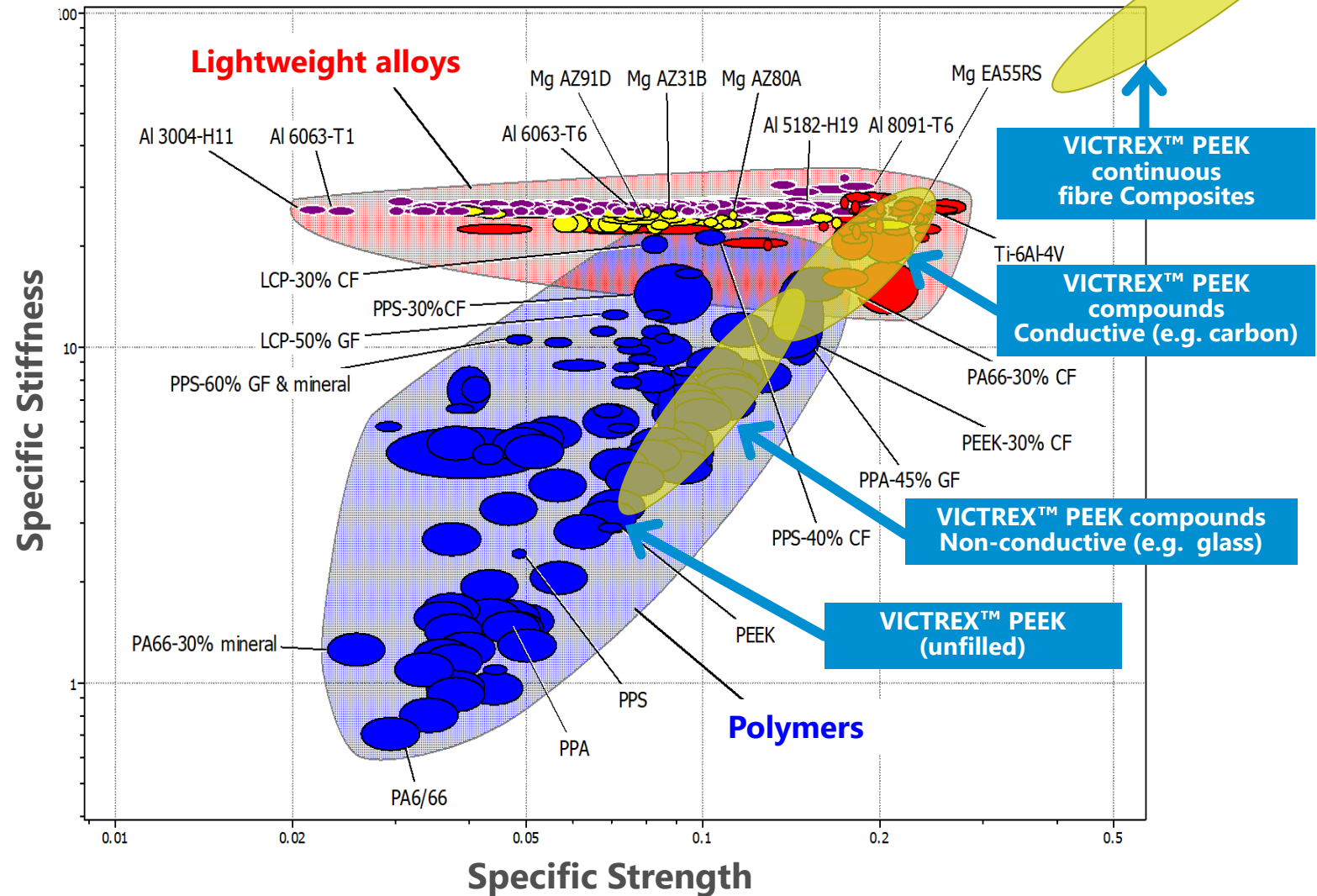
OPTIMISE PART DESIGN

Potential to save weight,
optimise part design &
increase performance
using VICTREX PAEK
composites.

VICTREX™ PAEK COMPOSITES ADVANTAGES

- ✓ Reduced Weight
- ✓ Part integration
- ✓ Anisotropic properties
- ✓ Fatigue Resistance
- ✓ Non-Corroding

WHY
REPLACE
METALS?



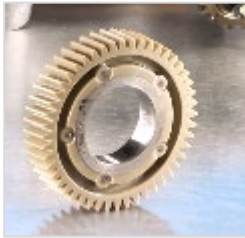
* Data Source: Chart/Data/etc from GRANTA selector 2020, Granta Design Limited, Cambridge , UK, 2020

Victrex PAEK carbon composites higher strength & stiffness to weight than metals

Compound : a short fibre reinforced composite, Composite: a continuous fibre reinforced, usually based on woven fabric or uni-directional tape

VICTREX™ PEEK

One of the highest performing polymers in the world



HIGH
PERFORMANCE
POLYMERS

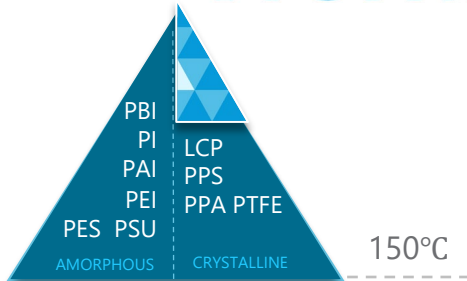


ENGINEERING
POLYMERS



COMMODITY
POLYMERS

VICTREX™ PEEK



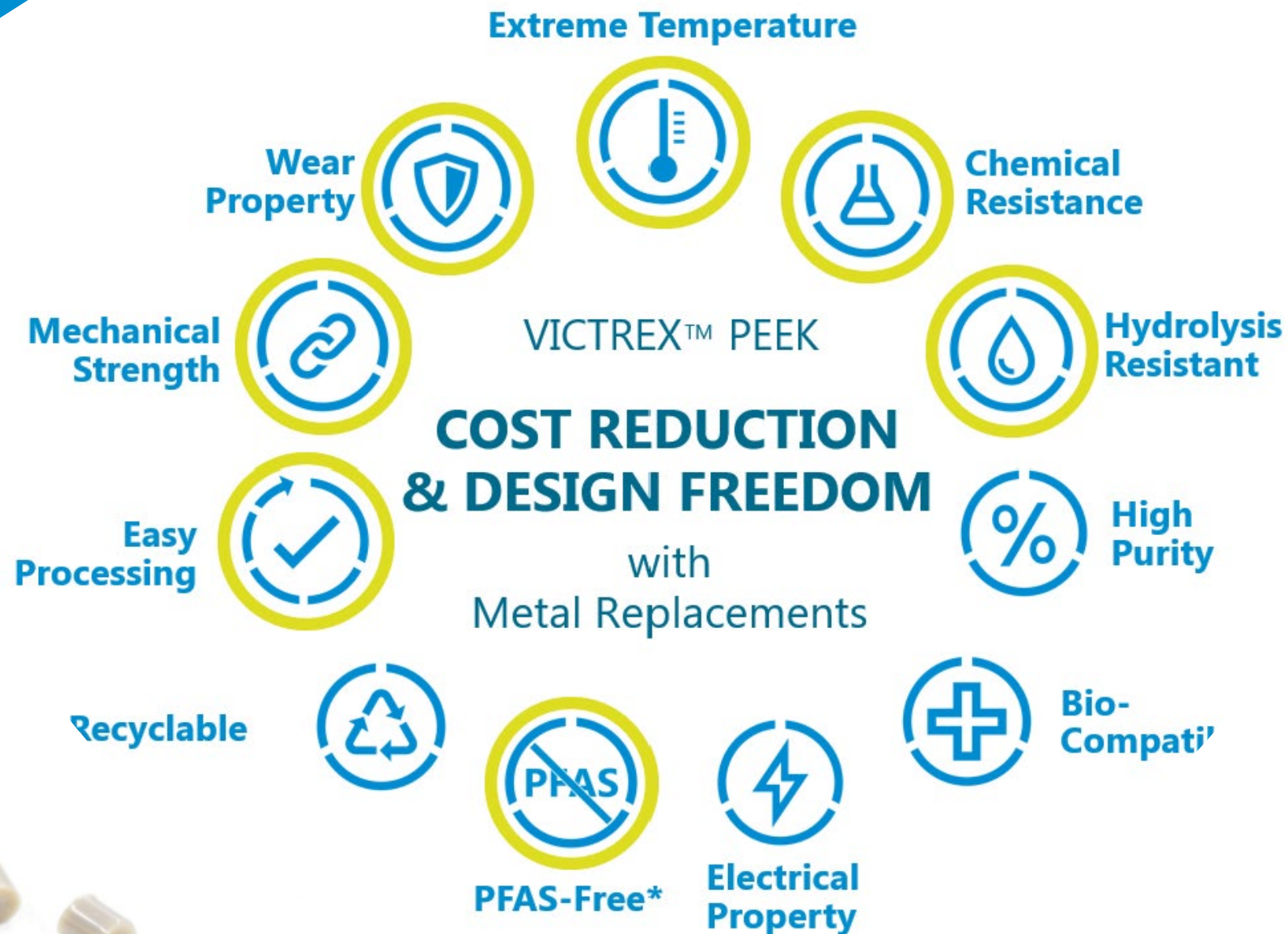
150°C

100°C

PE PVC PP PS ABS
PMMA PVA PVDC PET etc...

VICTREX™ PEEK

A unique combination of properties
to realise design freedom and cost
reduction benefits



WHY REPLACE METALS?

KEY BENEFITS OF REPLACING METAL WITH VICTREX™ PEEK

► COST REDUCTION

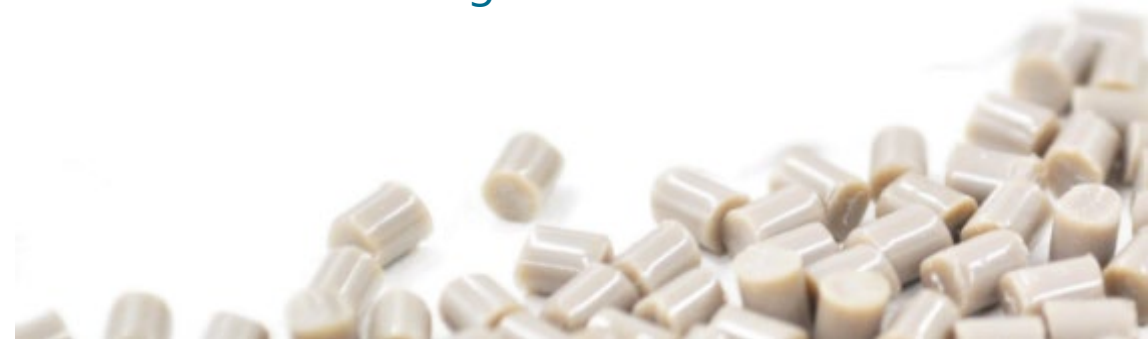
- Parts manufacturing costs
- Reducing downtime

► ENERGY EFFICIENCY

- Weight reduction
- Friction loss

► DESIGN FREEDOM

- NVH reduction
- Electrical insulation
- Anti-corrosive/hydrolysis
- Process-ability (Moulding vs Machining)
- Parts integration



METAL REPLACEMENT with Victrex Polymers

PARTS COST REDUCTION

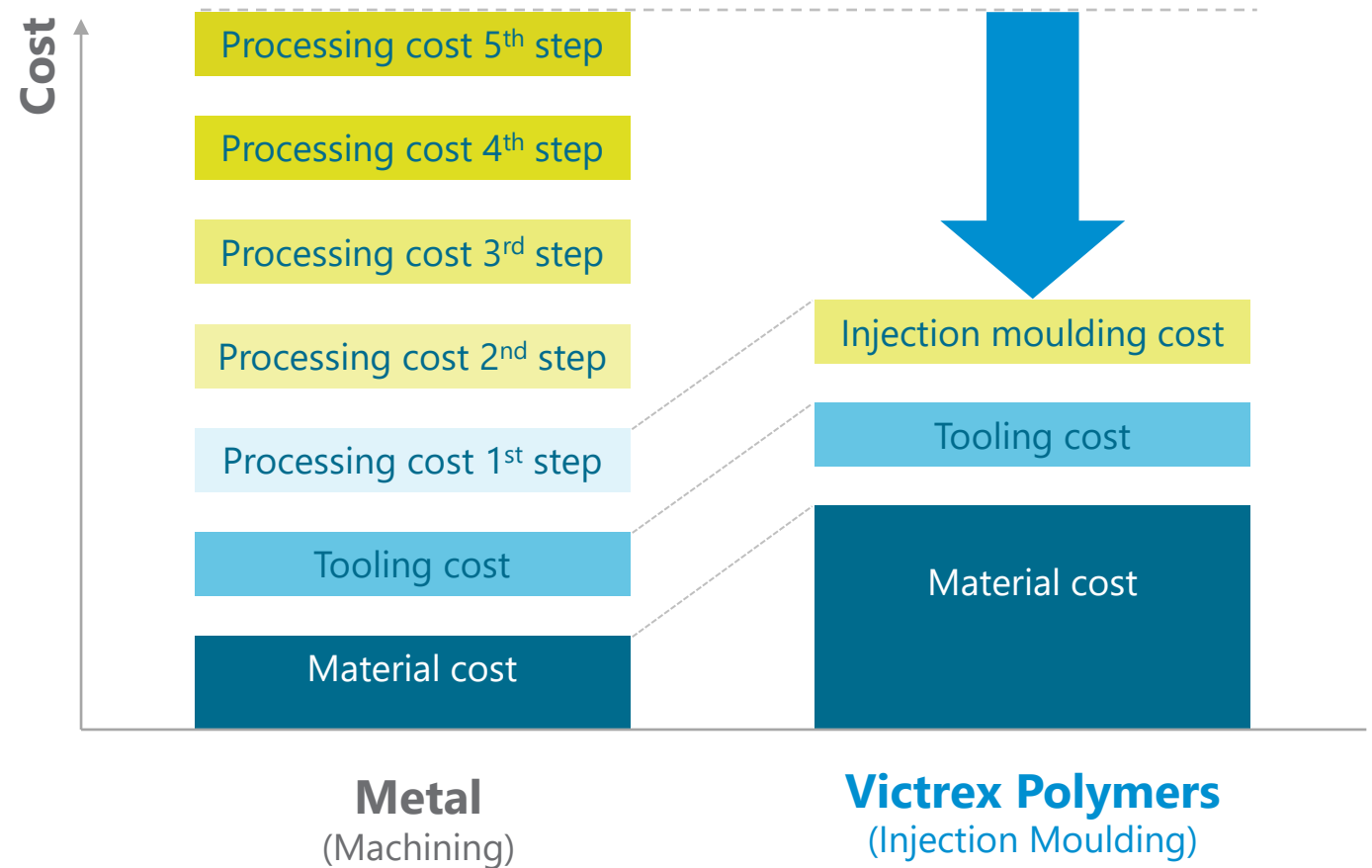


REDUCING PARTS MANUFACTURING COSTS

Injection moulding vs. Machining

Mass produced parts with multiple processing steps have good chance for total cost reduction with Victrex polymers and injection moulding.

The more complex the parts, the higher potential of cost reduction.



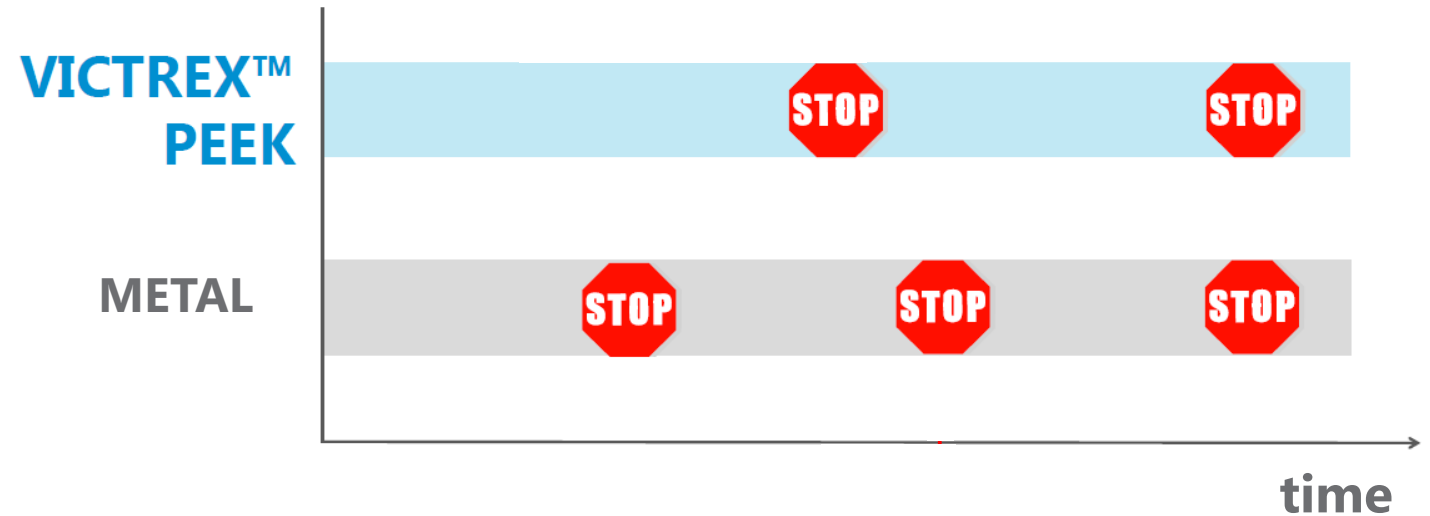
METAL REPLACEMENT with Victrex Polymers

COST REDUCTION



REDUCING OPERATION DOWNTIME BY EXTENDING PARTS LIFETIME

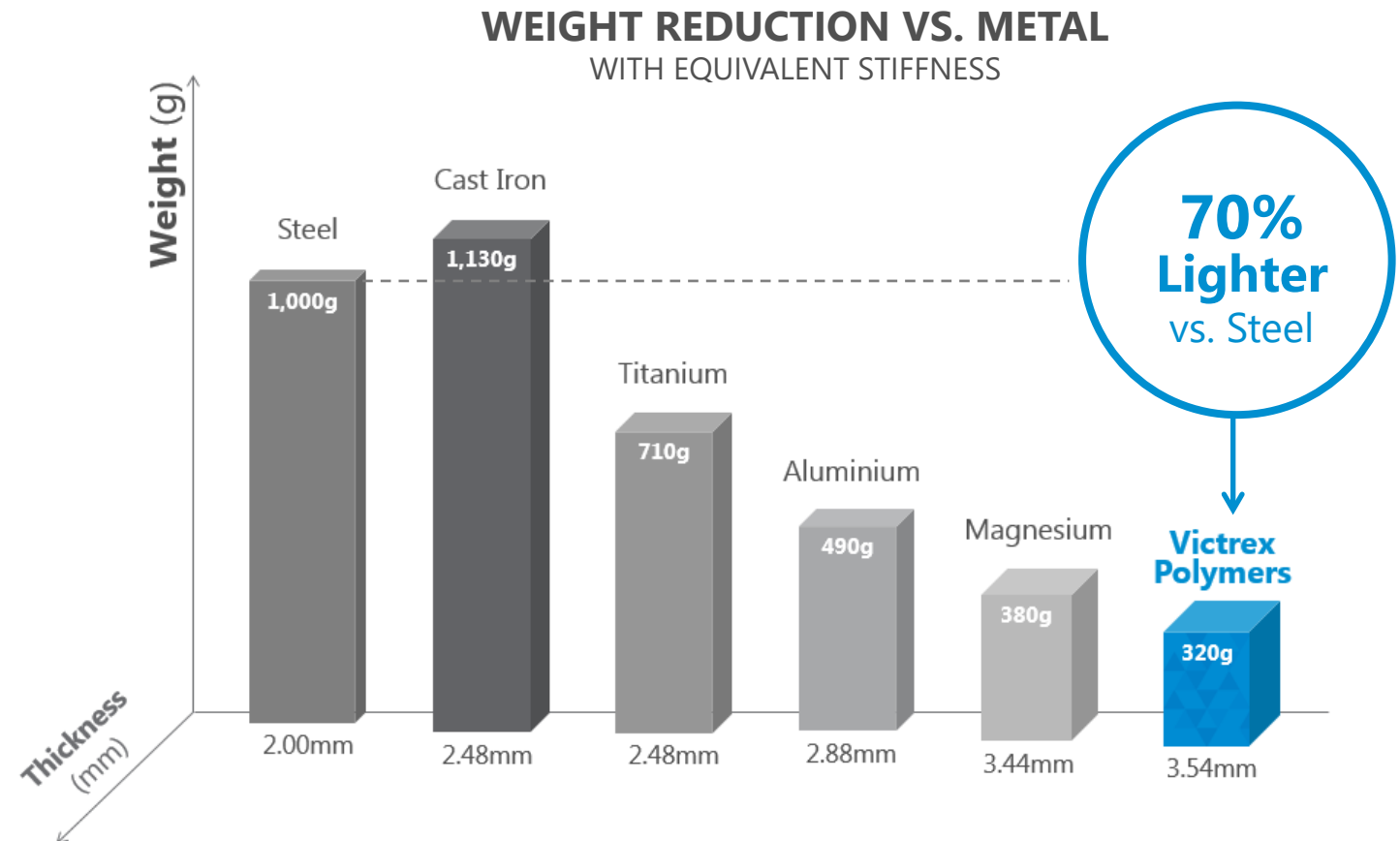
By extending lifetime of parts operating in extreme environments, you can reduce maintenance costs and reduce frequency of costly downtimes.



ENERGY EFFICIENCY

IMPROVING FUEL EFFICIENCY THROUGH WEIGHT REDUCTION

For the same stiffness a PEEK part is 70% lighter than equivalent Steel part. This weight saving means that manufacturers in the transportation industry for instance can produce lighter vehicles or planes that enable compliance to strict environment regulations around CO₂ emissions and fuel economy.

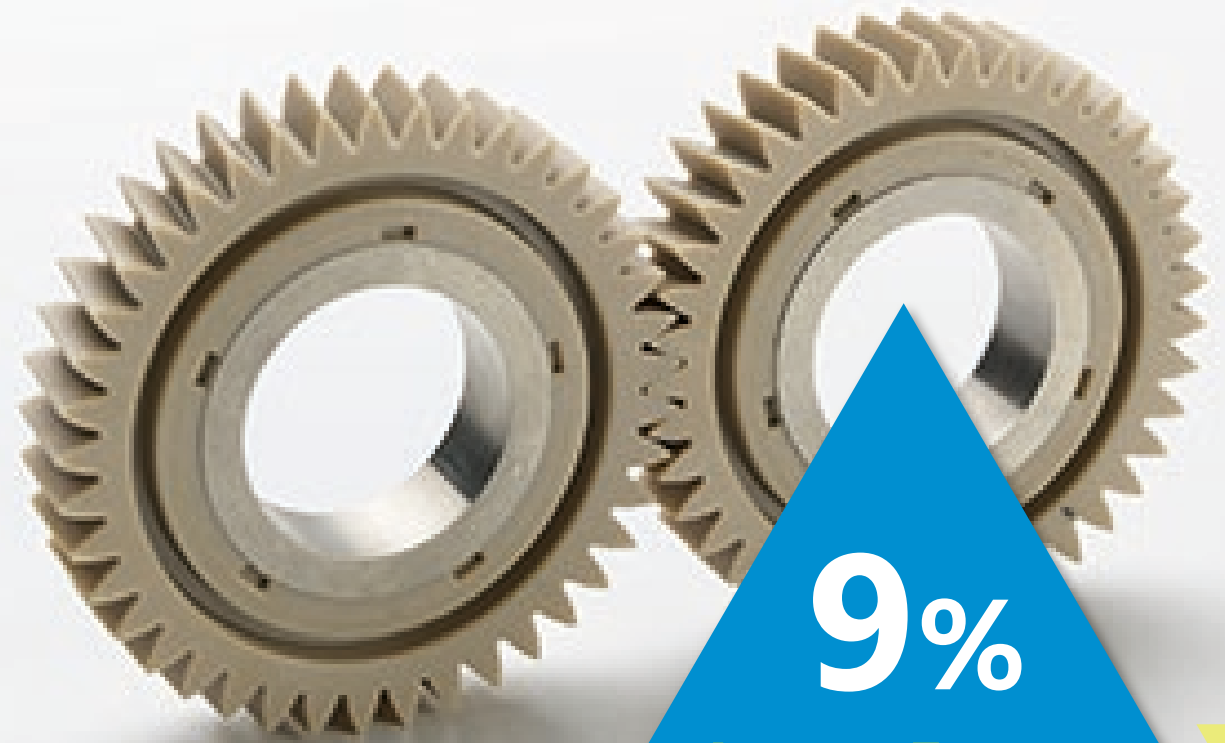


METAL REPLACEMENT with Victrex Polymers

ENERGY EFFICIENCY

IMPROVING FUEL EFFICIENCY BY REDUCING FRICTIONAL LOSS

When compared to grey cast iron gear, VICTREX™ PEEK gears offers overall system efficiency by 9% through a 78% lower MOI (Moment of Inertia) and 68% less weight.



9%

Lower Energy
Consumption*

(*Source: Metaldyne Study 2012)

METAL REPLACEMENT with Victrex Polymers

DESIGN FREEDOM

NVH REDUCTION

Lightweight + lower CoF + good wear property means lower noise, vibration and harshness. In a comparison between PEEK polymer gears and metals gears, 3dB noise reduction was possible. This is equivalent to approx. 50% noise reduction for the human ear.

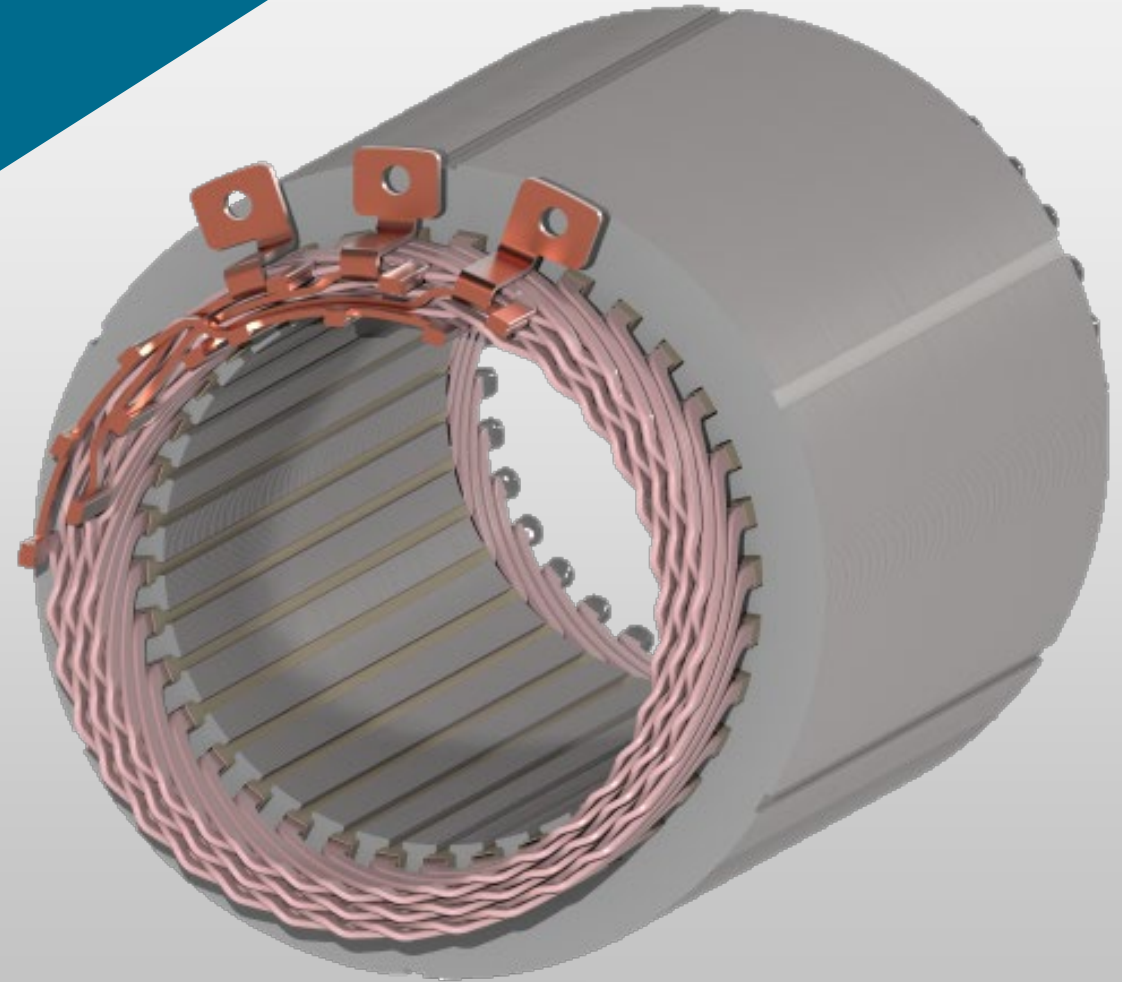


METAL REPLACEMENT with Victrex Polymers

DESIGN FREEDOM

ELECTRICAL INSULATION

Unlike metal, polymers do not have electrical conductivity. Or, by adding carbon fibers you can adjust the level of conductivity and control static electricity in electrically sensitive environments. Also, by using ultra thin PEEK film, electrical insulation in extreme environments can be achieved in a very limited space. (as in the slot liner)



METAL REPLACEMENT with Victrex Polymers

DESIGN FREEDOM

ANTI-CORROSIVE / HYDROLYSIS

With PEEK polymers you do not need to worry about parts failure due to corrosion or oxidization without any coatings or protection treatment, due to its excellent chemical and hydrolysis resistance.



METAL REPLACEMENT with Victrex Polymers

DESIGN FREEDOM

PROCESS-ABILITY

With its excellent process-ability, you can design very complex parts and still mass produce them with injection moulding.



METAL REPLACEMENT with Victrex Polymers

DESIGN FREEDOM

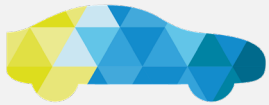
PARTS INTEGRATION

Process-ability that enables injection moulding of complex parts means there are more opportunity to integrate multiple parts into one. For the parts manufacturer, parts integration can lead to cheaper & faster manufacturing of the parts, and for OEMs and Tiers having fewer parts can lead to a more simplified supply chain, quality control process, assembly flow....etc.



METAL REPLACEMENT with Victrex Polymers

APPLICATION EXAMPLES



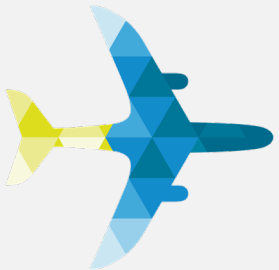
Automotive

Bearings, bushings and sealing and components, slot-liners.



Energy & Industrial

Compressor rings, pipes and tubes, seal rings, bearings, electrical connectors, impellers gears.



Aerospace

Brackets, clamps, structural fasteners, wire insulation, pipes,



Electronics

Semiconductor wafer handling, storage and transfer, bearing surfaces, battery housing.

SHAPING FUTURE PERFORMANCE™

WWW.VICTREX.COM



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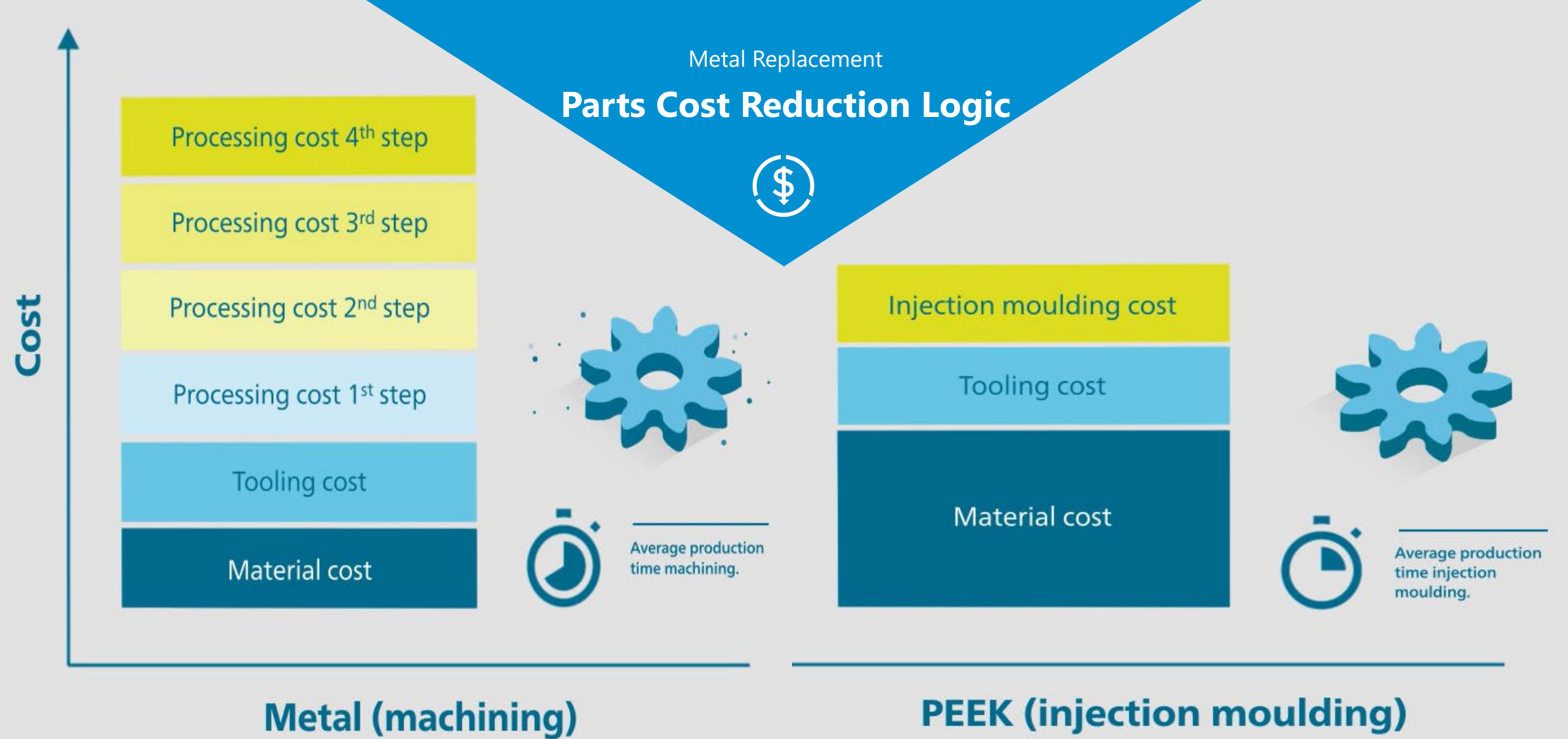
**WHY
REPLACE
METALS?**

“If I had an hour to solve a problem and my life depended on the solution, I would spend the first 55 minutes determining the proper question to ask.

For once I know the proper question: I could solve the problem in less than five minutes. ”

- Albert Einstein

$$E=mc^2$$



The more complex the parts, the higher potential of cost reduction