ELG HANIEL GROUP

Closing the Recycling Loop to Deliver Value

AFRA Conference
Montreal Canada
July 2019

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Contents

1. ELG Haniel Group

We are a part of the family-owned Haniel Group portfolio

Divisions

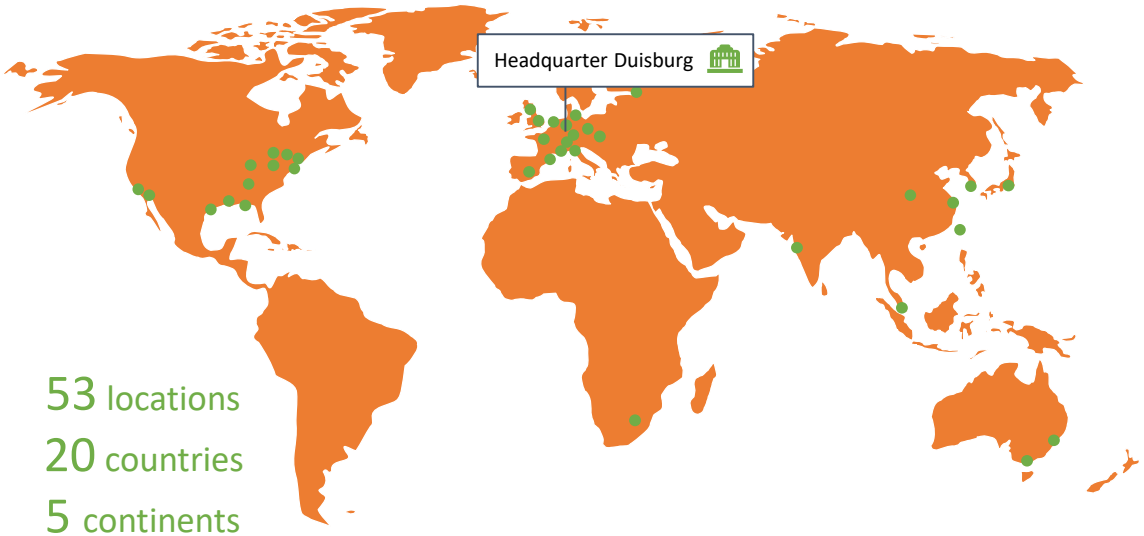
BekaertDeslee	CWS-boco	ELG	Optimar	ROVEMA	TAKKT
Equity interest 100 %	Equity interest 82.19 %	Equity interest 100 %	Equity interest 100 %	Equity interest 100 %	Equity interest 50.25 %
					
BekaertDeslee is the leading specialist for the development and manufacturing of woven and knitted mattress textiles.	CWS-boco ranks among the leading international full-service providers of hygiene services and textile services.	ELG is a global leader in the trading, processing and recycling of raw materials for the stainless steel industry as well as high performance materials such as superalloys, titanium and carbon fibres.	Optimar is a global leader for automated fish handling systems. It develops, produces and installs solutions for use on ships, on land and for fish farms.	ROVEMA is an international leading manufacturer of packaging machines and systems for the most different products and applications.	TAKKT bundles a portfolio of B2B direct marketing specialists for business equipment in Europe and North America in a single company.

Strategic perspective: one of the leading Family Equity Holding Companies

ELG Haniel is a global leader in recycling of valuable resources: Stainless Steel and High Performance Materials such as Carbon Fiber, Superalloys, Aluminum and Titanium.

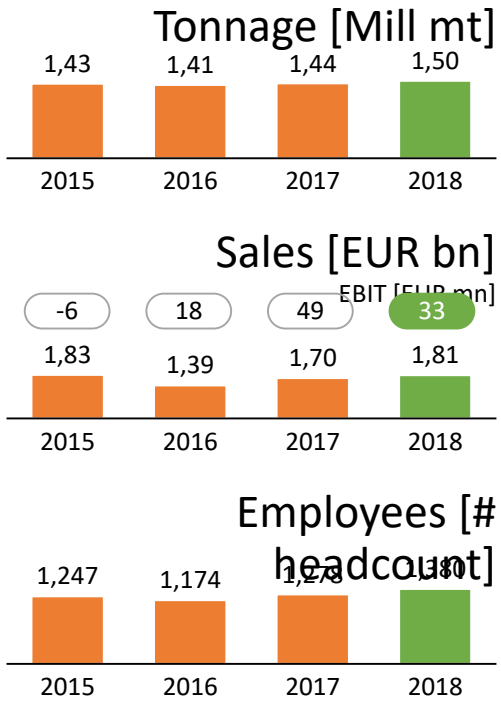
Company profile

Global presence

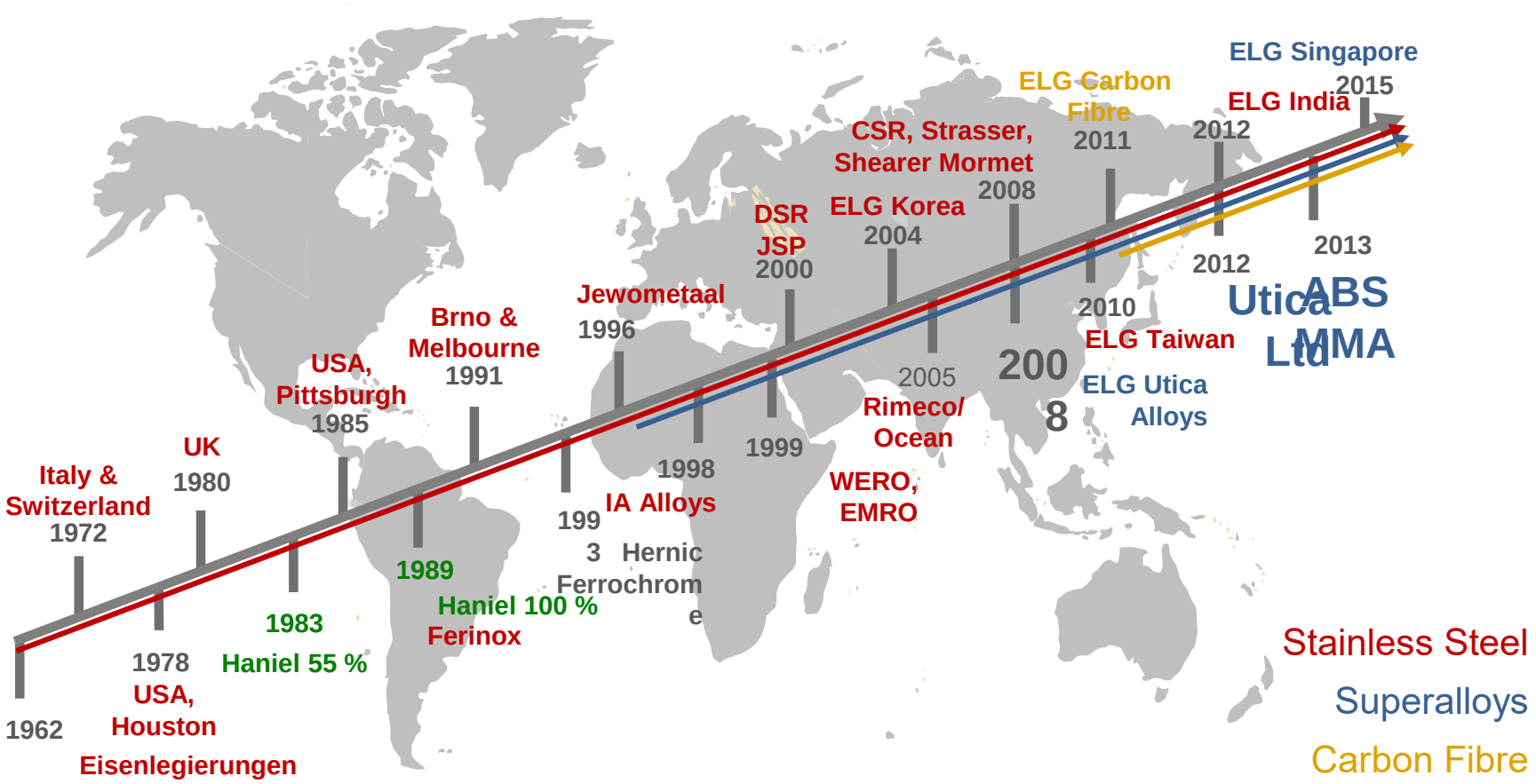


53 locations
20 countries
5 continents

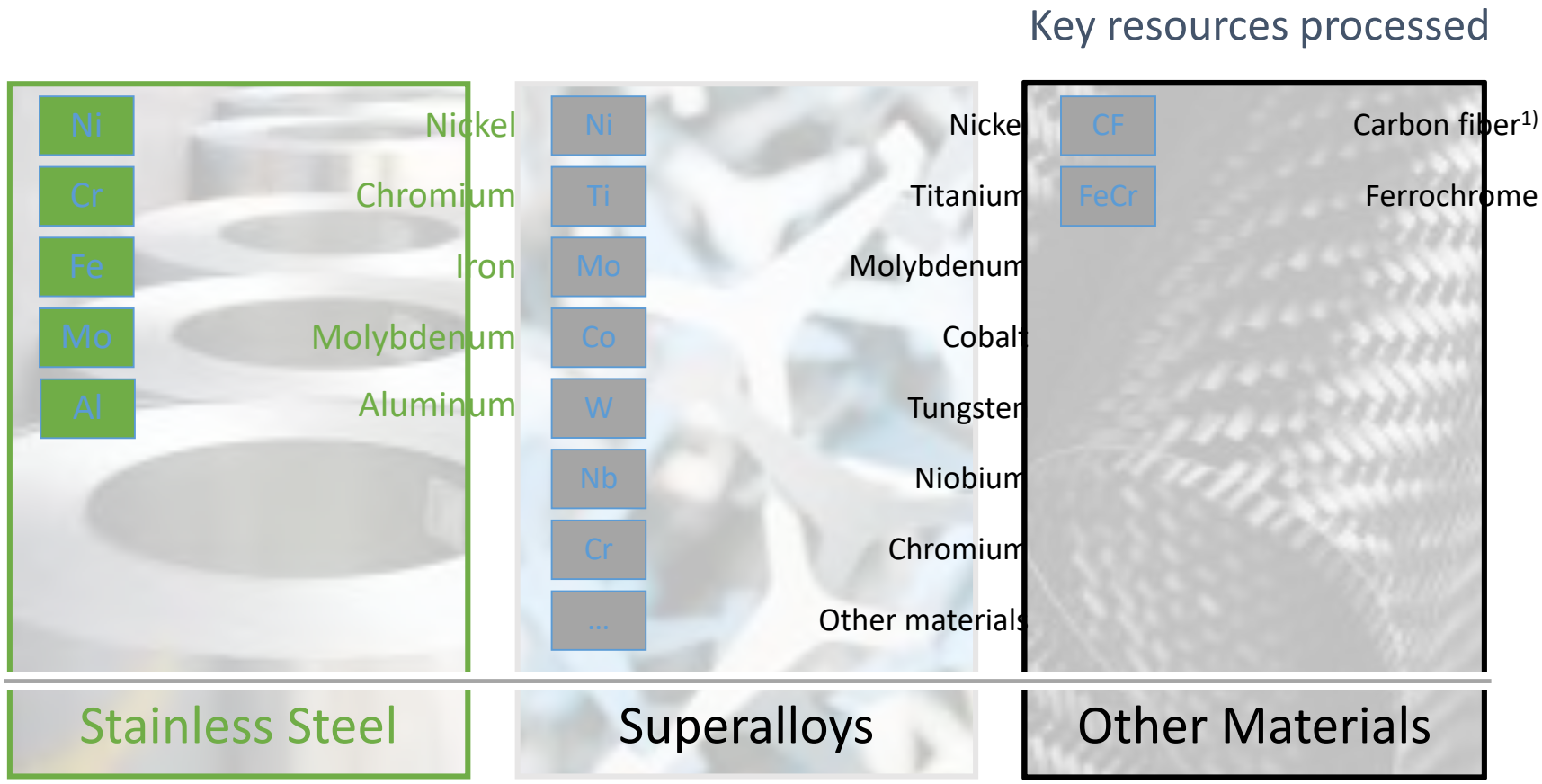
Key figures



As a group, we can rely on more than 55 years of experience



We deliver value by identifying the best usage of collected resources and processing them for the most suitable application

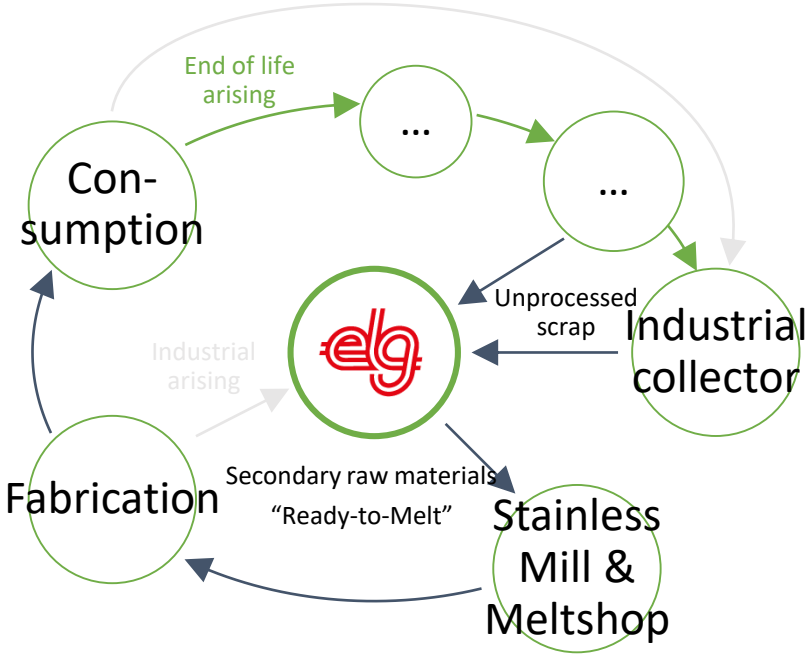


1) Carbon Fibers reclaimed from CFRPs through pyrolysis process

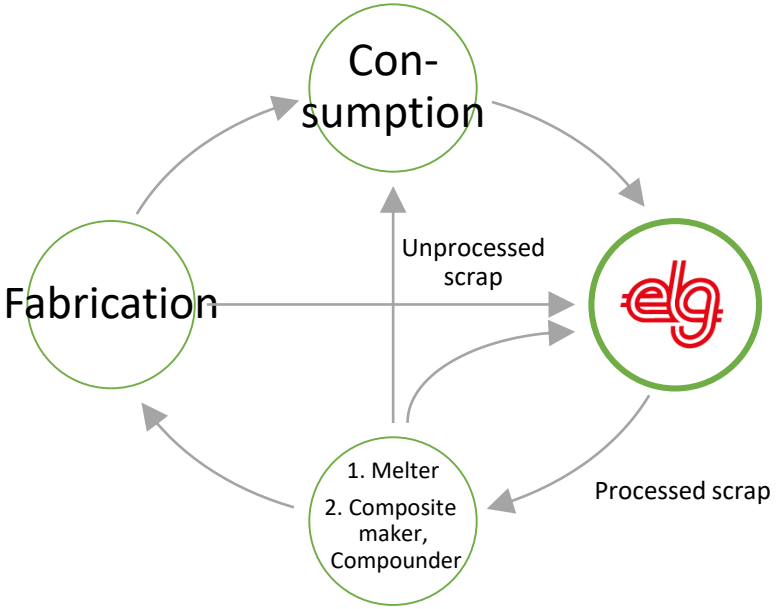
We are an integral part of the value chain in stainless steel, superalloys, and titanium. We are a growing presence in Al and CF

Arising and collecting of scrap depending on manufacturing and product life cycle

Stainless steel



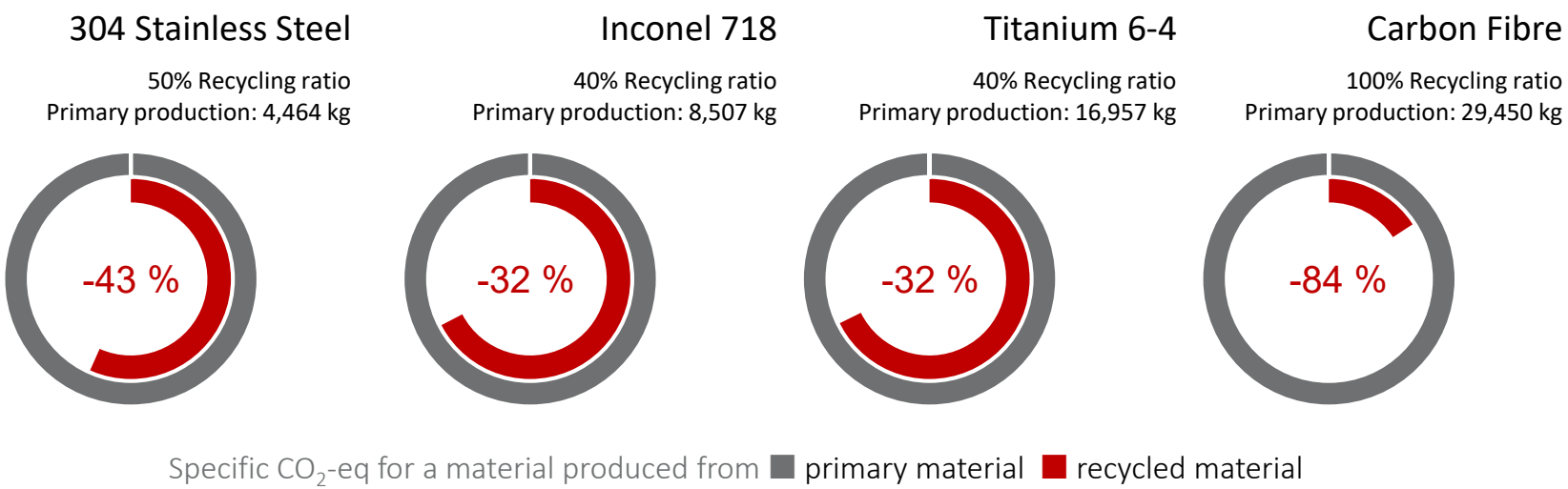
1. Superalloys, 2. Carbon Fiber



ELG's business model significantly reduces CO_2 Footprint:
In 2018 ELG saved the equivalent of 4.4 million tons of CO_2

Carbon footprint when using primary and recycled raw materials

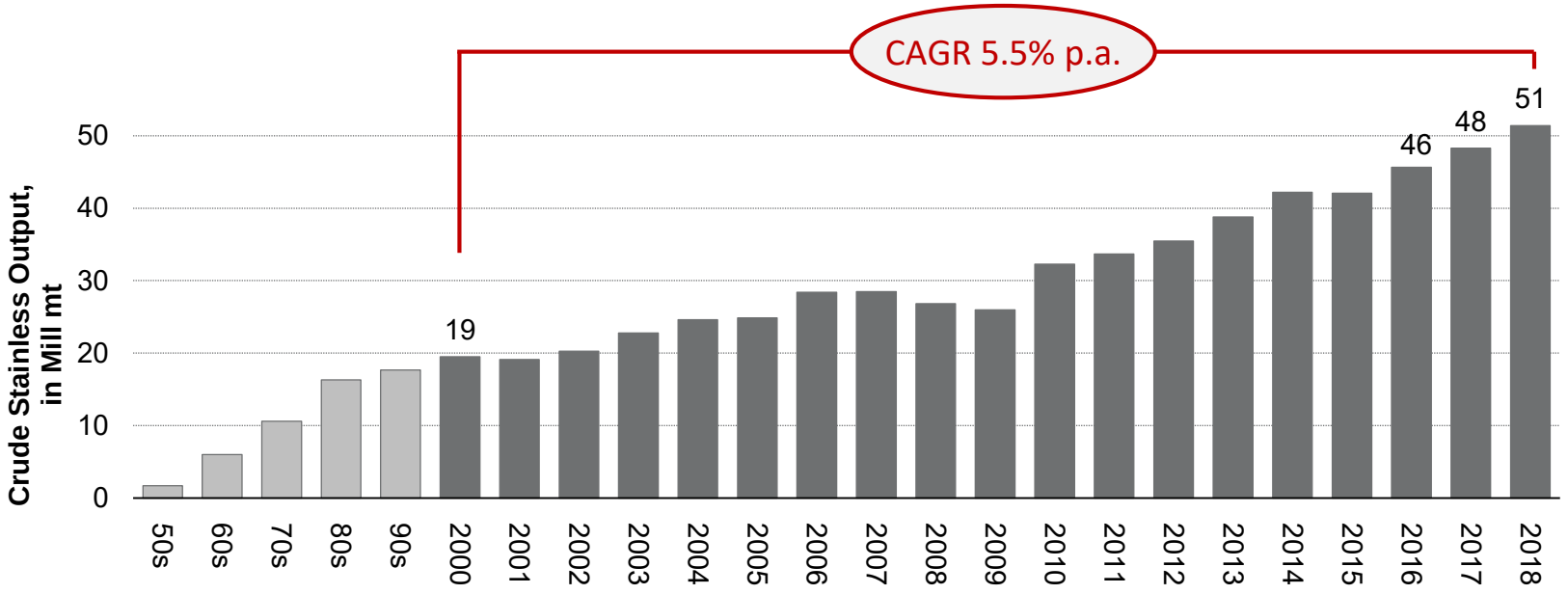
Fraunhofer UMSICHT



Data: 2015, 2017, based on calculations by Fraunhofer Umsicht and ELG; ELG Haniel Group Sustainability Report Update 2018

2. ELG Stainless Segment

Stainless steel is a growing commodity - rise in demand driven by economic growth and increasing prosperity

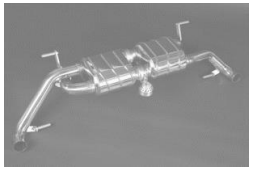


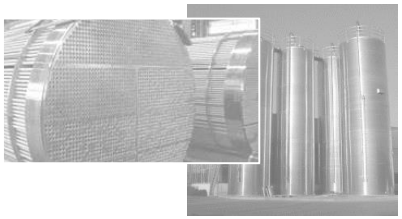
- Stainless steel has enjoyed a long-term historic growth rate of 5-6% p.a.
- 2018 also saw the stainless segment growing by approximately 6%
- China, India and Indonesia are major regional drivers for growth

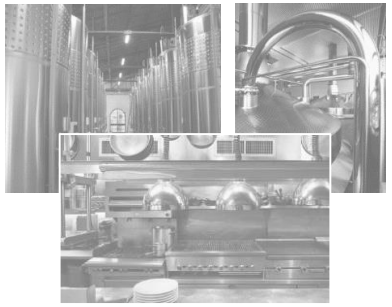
Source: CRU International, ELG Haniel Analysis

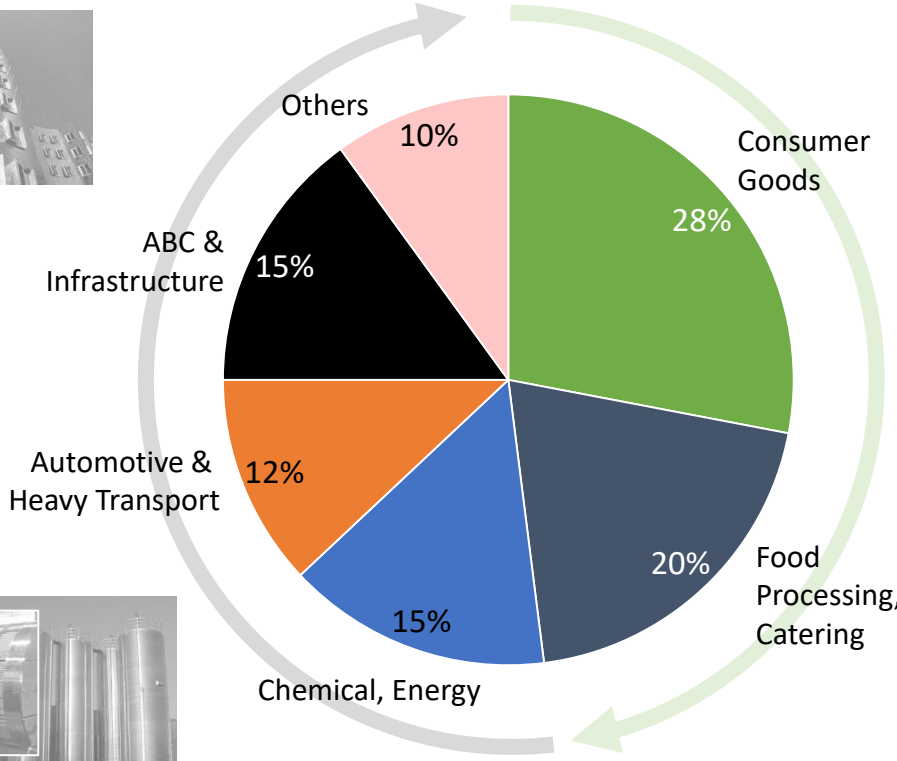
Stainless steel is being used in diverse applications – consumer and industry applications driving demand

In 2018, some 43 Mill mt of stainless finished products are being used









Source: Steel & Metals Market Research SMR GmbH, 2019

The cost of making stainless steel hinges on raw materials;
Nickel is a key value driver

"The price of the alloys in the charge materials plays a decisive role. […] for overall success, the buying is of very much greater importance.

Errors made in buying can only be partially corrected by the steelmaker."

Köhler & Unger, Thyssen Edelstahlwerke AG, Werk Krefeld, 1986

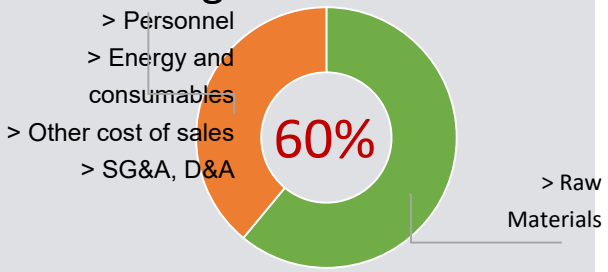
"Procurement strategy key for stainless steel sector growth."

"Depending on the series […] raw material constitutes about
70% of the total cost of production."

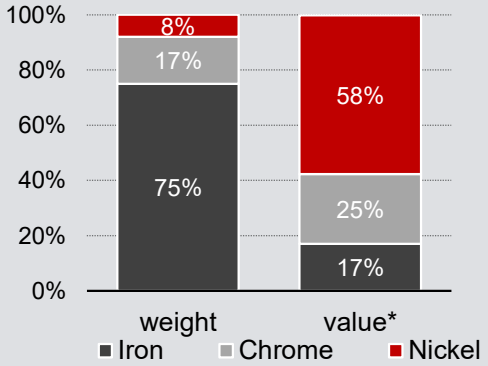
"Purchasing is done considering the ‚Total Cost of Ownership'
method and the material mix is on the basis of requirement
generated through the optimizer 'value in use' model."

R. Ganesh, Jindal Stainless, 2018

Typical raw materials cost share (2018) in making stainless steel

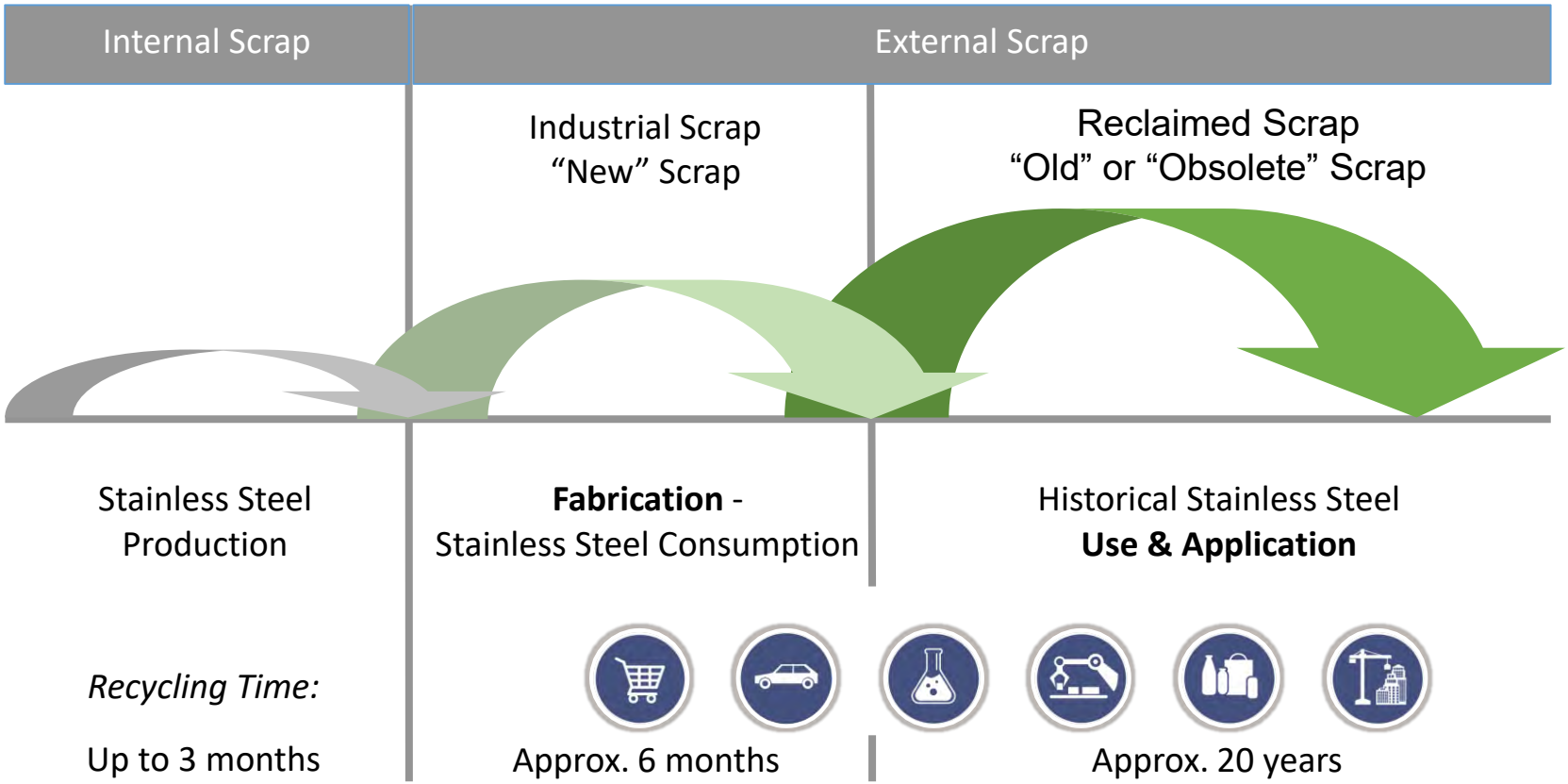


In 304 stainless, nickel is the value driver



Daniel Analysis, European Stainless Producers Annual Reports; *Calculation based on 2018 average nickel price of 13,100 USD/mt

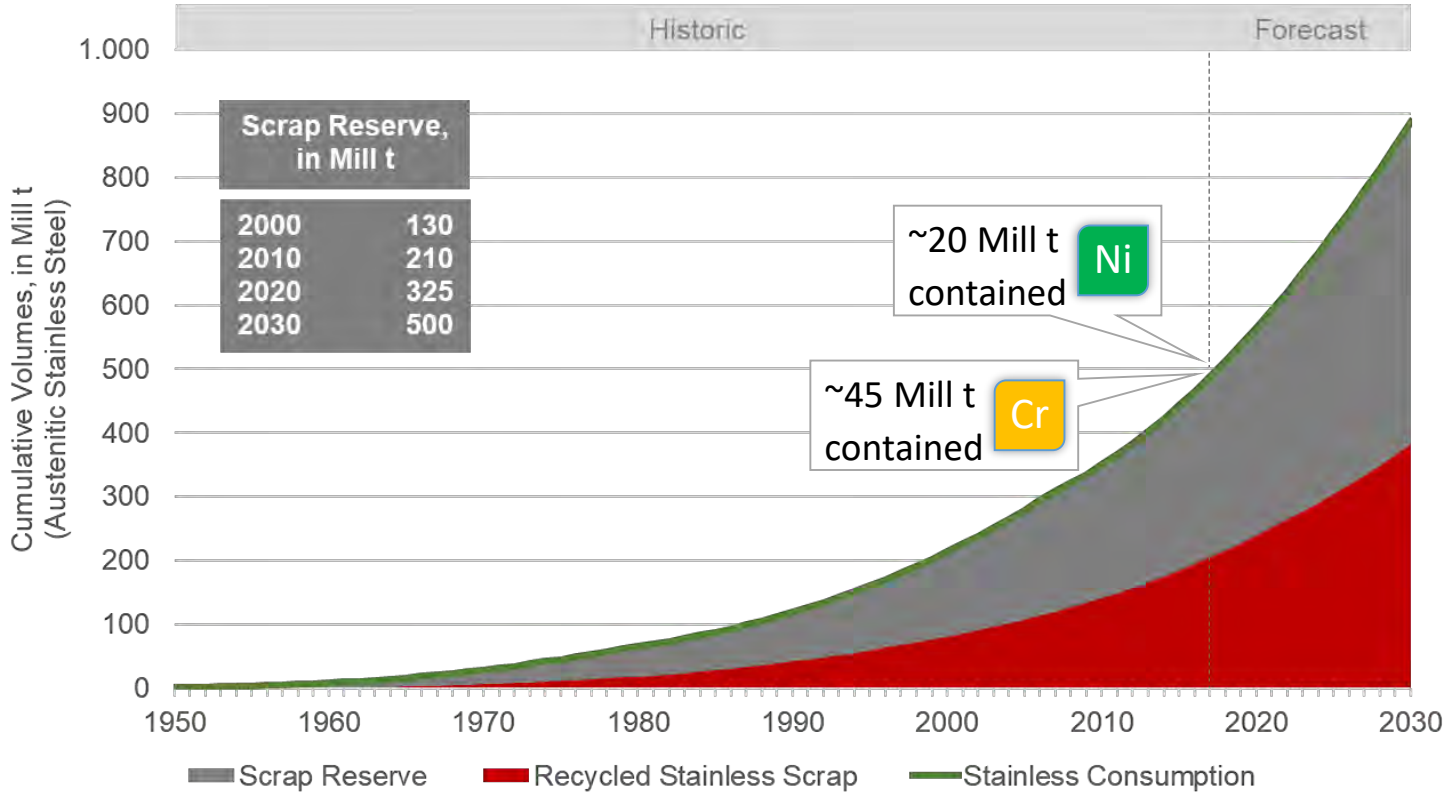
Availability of stainless steel scrap is a function of past usage,
stainless may stay „in-use“ for up to 20 years or more



Source: ELG Haniel Analysis

Stainless scrap availability is supported by strong demand growth rates in the past leading to an increasing scrap reserve

Historic cumulative stainless steel usage and scrap reserve

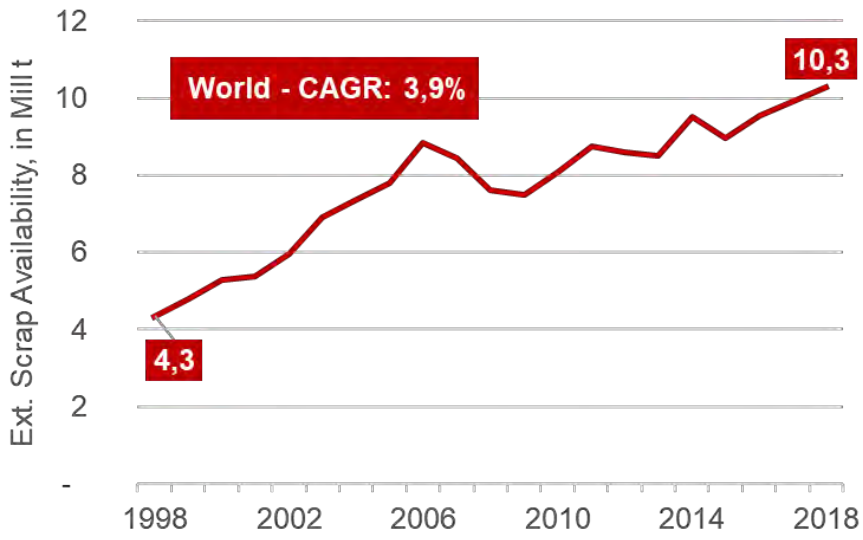


Definition: Scrap reserve = cumulated stainless steel consumption minus cumulated stainless scrap usage (i.e. recycled scrap) = stainless steel to be recycle

Source: ELG Haniel Analysis

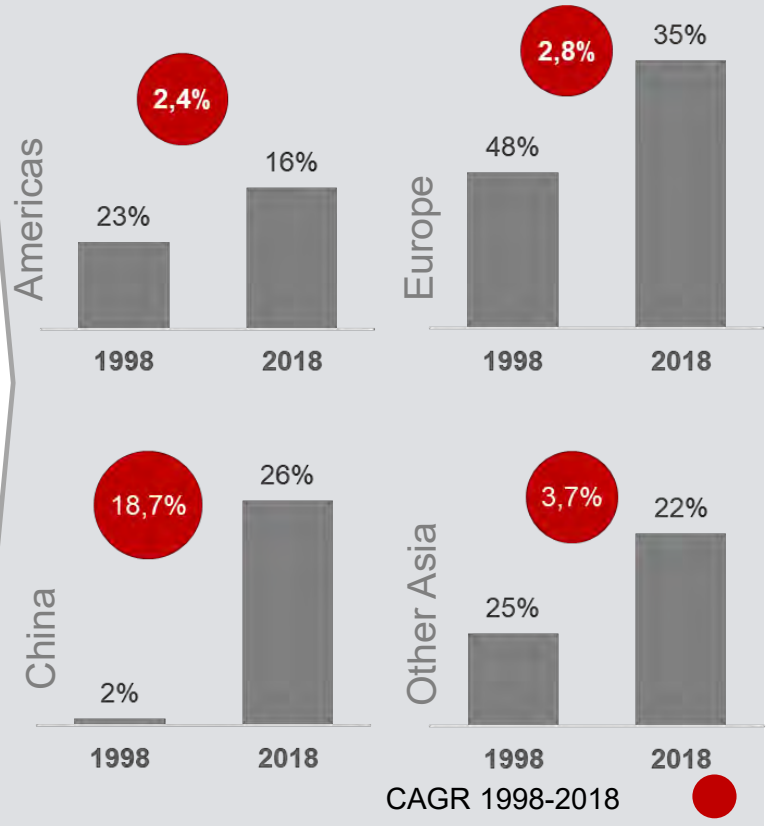
Worldwide external stainless scrap availability has grown by approximately 4% p.a in the past 20 years

Global External Scrap Availability



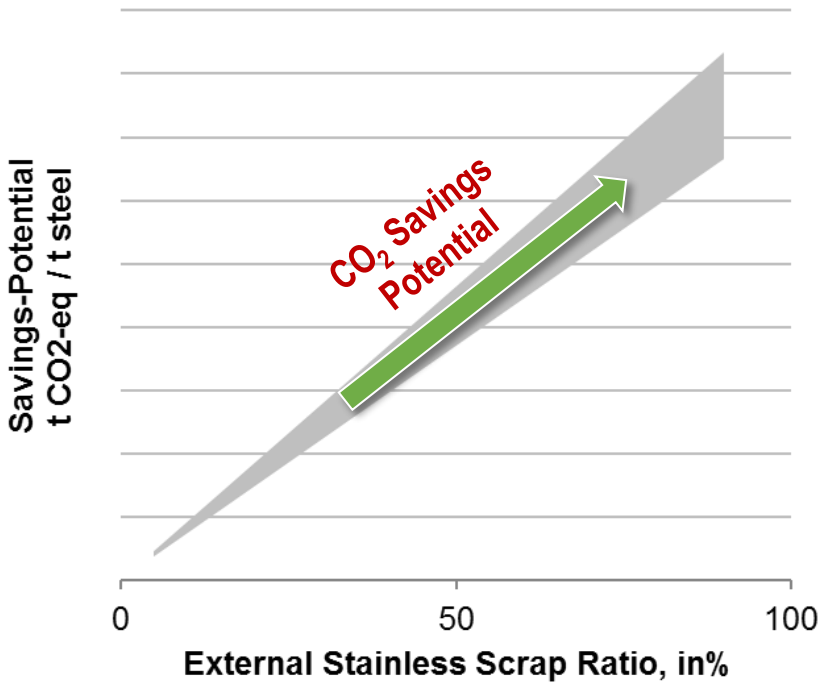
Availability of stainless scrap has increased globally, and scrap generation remains a local issue,
and a function of metal prices

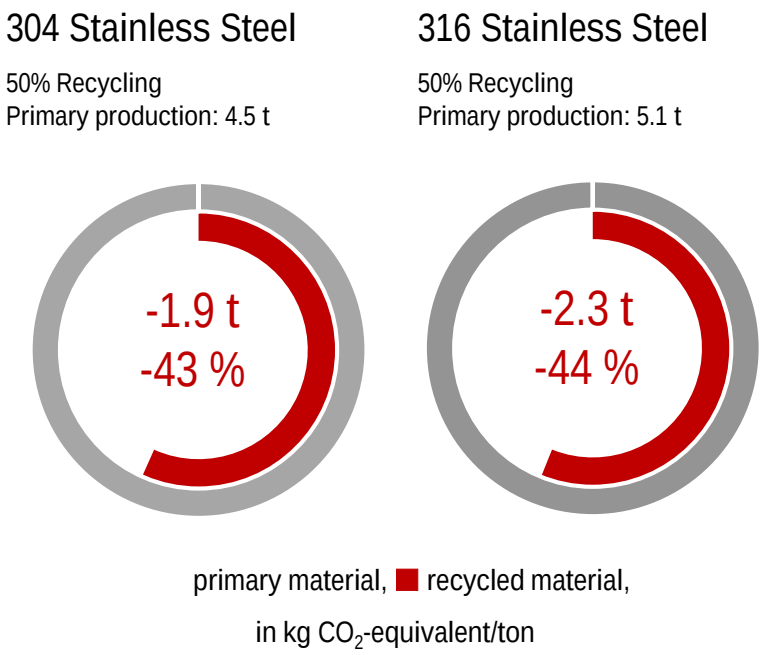
Scrap in Key Regions



Sources: SMR – Steel & Metals Market Research, ELG Haniel Analysis

Usage of stainless scrap significantly increases a stainless mill's CO_2 savings potential





Usage of scrap has a significant impact on stainless steel's carbon footprint:
Input of 50% recycled stainless steel lowers CO2 emissions by more than 40%

Source: ELG Haniel Analysis

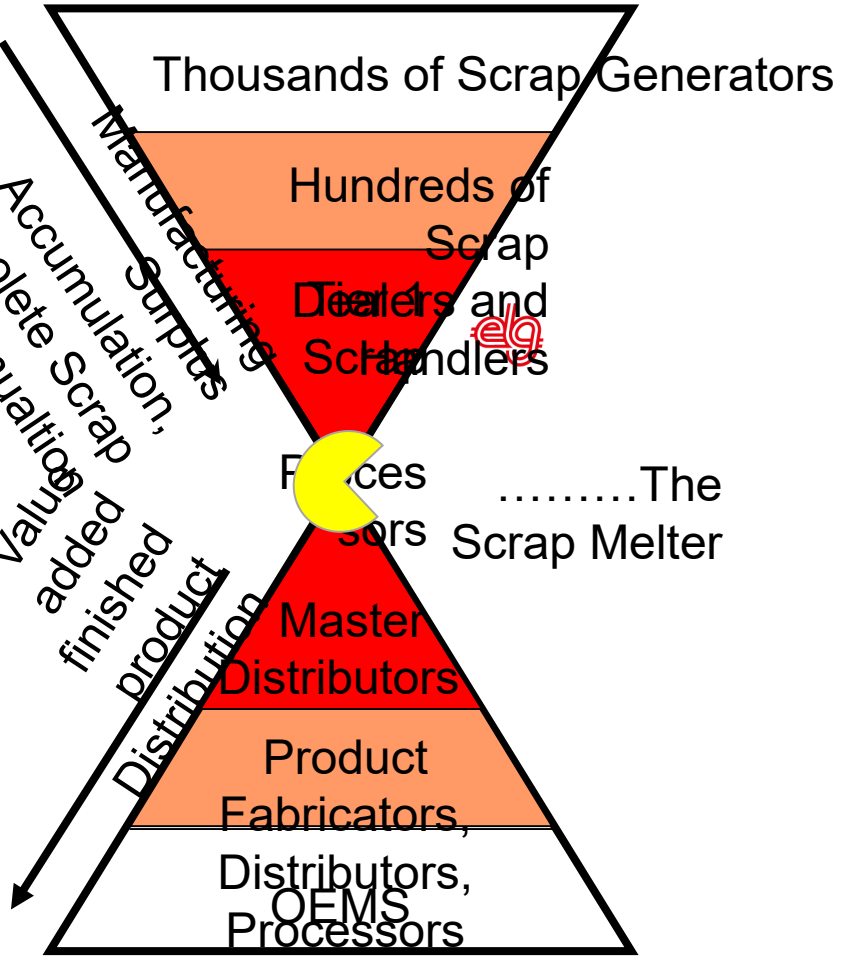
ELG is a tier 1 material processor and takes a central role in the recycling chain

Tier 1 material **processors**

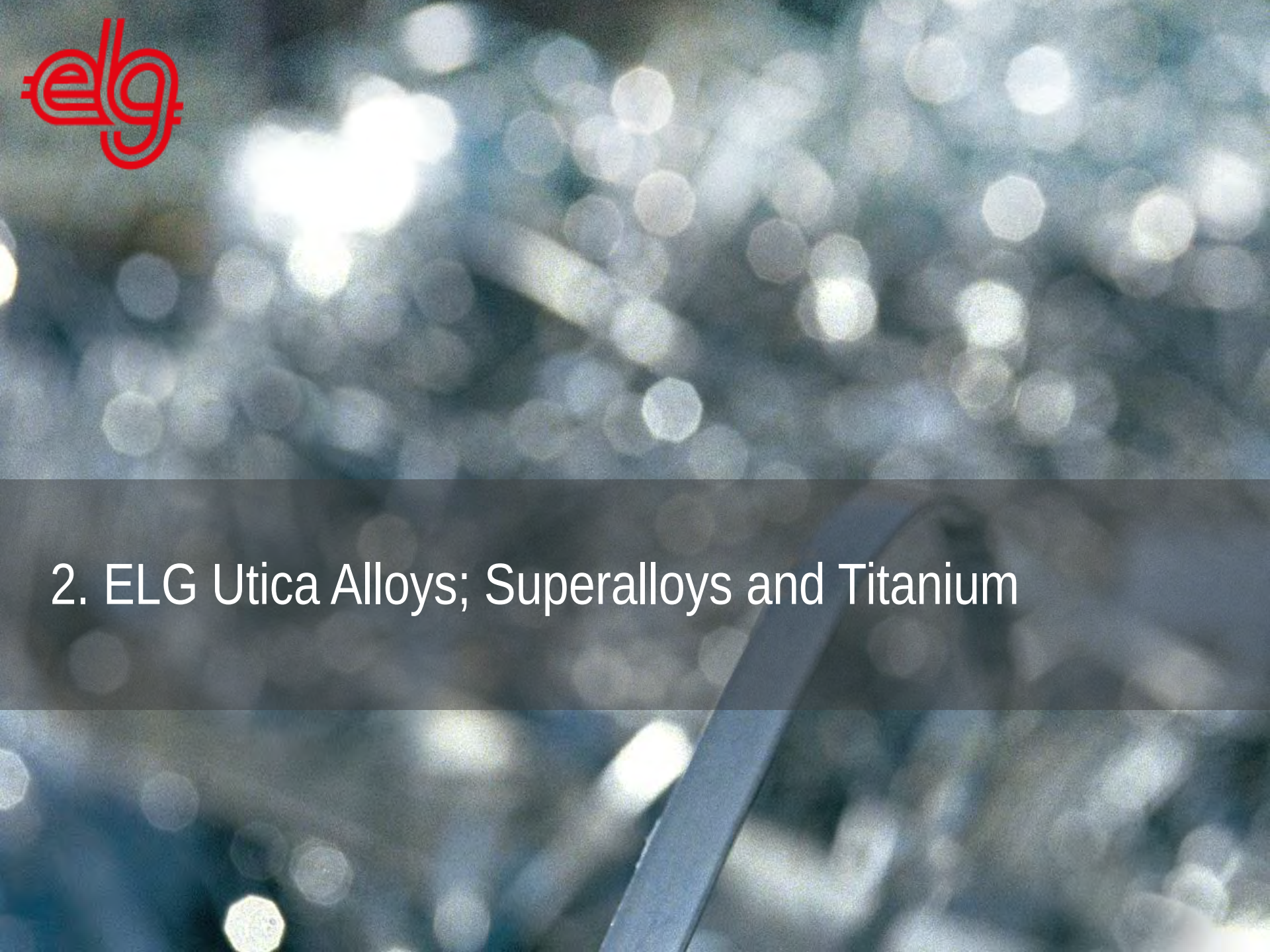
> Buy and process valuable material from small and medium-sized collectors

> Form link between local scrap market generators and raw material consumers purchasing globally

> Offer
- o *Just-in-time delivery*
- o *Bespoke quality, form, size and guaranteed chemistry*
- o Small barrel shipments (1mt) to *full furnace charges (100mt)*
- o *"Ready-to-Melt" blends*
- o Supply chain financing



Source: ELG Haniel Analysis

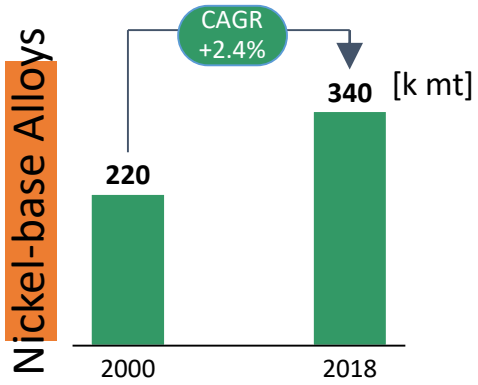


2. ELG Utica Alloys; Superalloys and Titanium

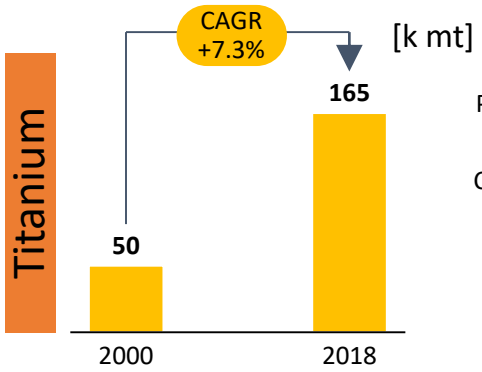
Aerospace is a key growth driver in the market segments for superalloys such as titanium and nickel-base alloys

Segment Growth

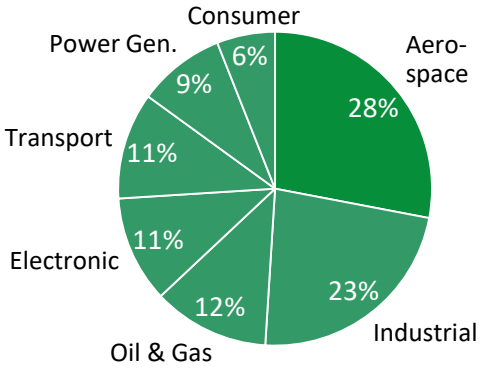
Nickel-base Alloys

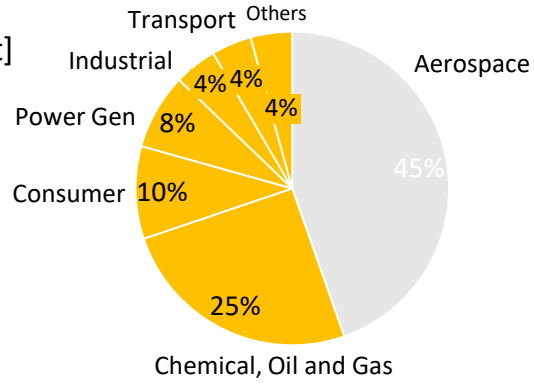


Titanium



Use Applications





Trends

> Nickel-base alloy segment highly cyclical due to large focus on aerospace and project business

> Long-term average growth rate of 2.5% p.a. so far Producer landscape still dominated by "Western" Hemisphere

> Top 10 producers represent >60% of global output (2018)

> Titanium market segment **also cyclical**

> As a technological material, demand growth has been driven by new applications and the compound annual **growth rate exceeds** that of the **stainless** segment

> **Lower growth rates** expected for the future – Growth driven by **China** and other **emerging markets**

Source: SMR, Roskill, ELG Haniel Analysis

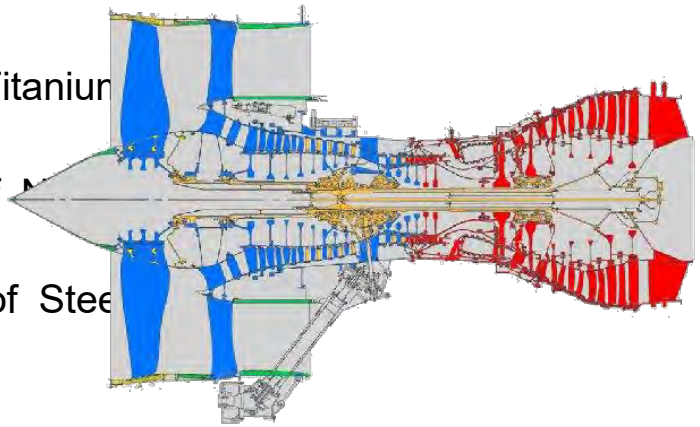
High Buy-to-Fly ratio in the aerospace industry drives superalloys scrap availability

Buy-to-Fly ratio of a typical large en

6.0 t of Titaniu

9.0 t of N

6.5 t of Stee



= 21.5 t to make a 6.0 t engine!

15.5 t (> 2/3) of high value manufacturing surplus material available for recycling.

ELG Utica Alloys reached several milestones in recent years and is increasing its role as service provider

Milestones ent Steps

+ Processing

+ Service
+ Global reach

+ Service &
new material
sources

Trading with Superalloys & Titanium

2000
- Started as special materials department within the Stainless world of ELG Duisburg

Processing of Superalloys & Titanium Scrap

2008 - 2013
- Expanding business by vertical Integration (purchasing, upgrading, selling)
- Certified supplier of the biggest Melting shops
- Unique processing technologies

Global Revert Programm Manager for OEM's

2013 – 2016
- Adding value to our customers Supply chains by being a global service provider for global OEMs
- EUA not only processor but Administrator and logistics company

Gas/Jet Turbines Destruction & Recycling

2016 – 2020
- Growth with the Aerospace Industry
- Continues Globalisation and Integration
- Certified destruction and recycling of jet engines and sensitive engine parts
- Precious Metals recovery
- Digitalisation of the
- Production processes (costs)
- Management of the Revert Scrap Data for the Customer (Service offering)

4. ELG Carbon Fibre Ltd.

ELG Carbon Fiber Ltd. – Details

Overview of the Business:

- First commercial scale carbon fiber recycling facility located in Birmingham UK
- ELG has been industrializing carbon fiber recycling technologies since 2011, building on 7 years of previous research.

Challenges that have been identified and overcome:

- Cost effective recovery of high quality carbon fibres—proven capability to recover close to 1,500 tonnes per year.
- Need for practical conversion routes—products developed for both the compounding and thermoplastic / thermoset composites industries.
- Lack of test data--in-house test laboratories established, external R&D projects established with OEM customers and research institutes.

ELG C[4]on Fiber Ltd. – Details

Carbon Fibre Reclaiming

- Metal removal and cutting of large composite structures to sizes suitable for downstream processing.
- Shredding of laminates and prepreg to enable efficient and consistent processing.
- Fibre recovery via a modified pyrolysis process.


Shredding

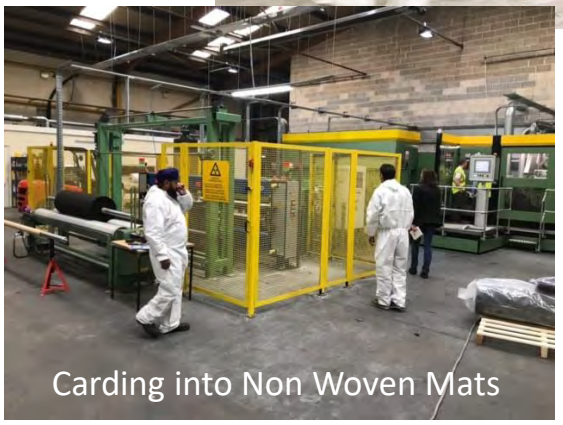
Carbon Fibre Conversion

- Milling and Chopping to exact length
- Nonwoven Mat production. (Carding to make a felt product)
- Injection Moulding Pellet production for chopped and milled fibers. (through partners)


Pyrolysis

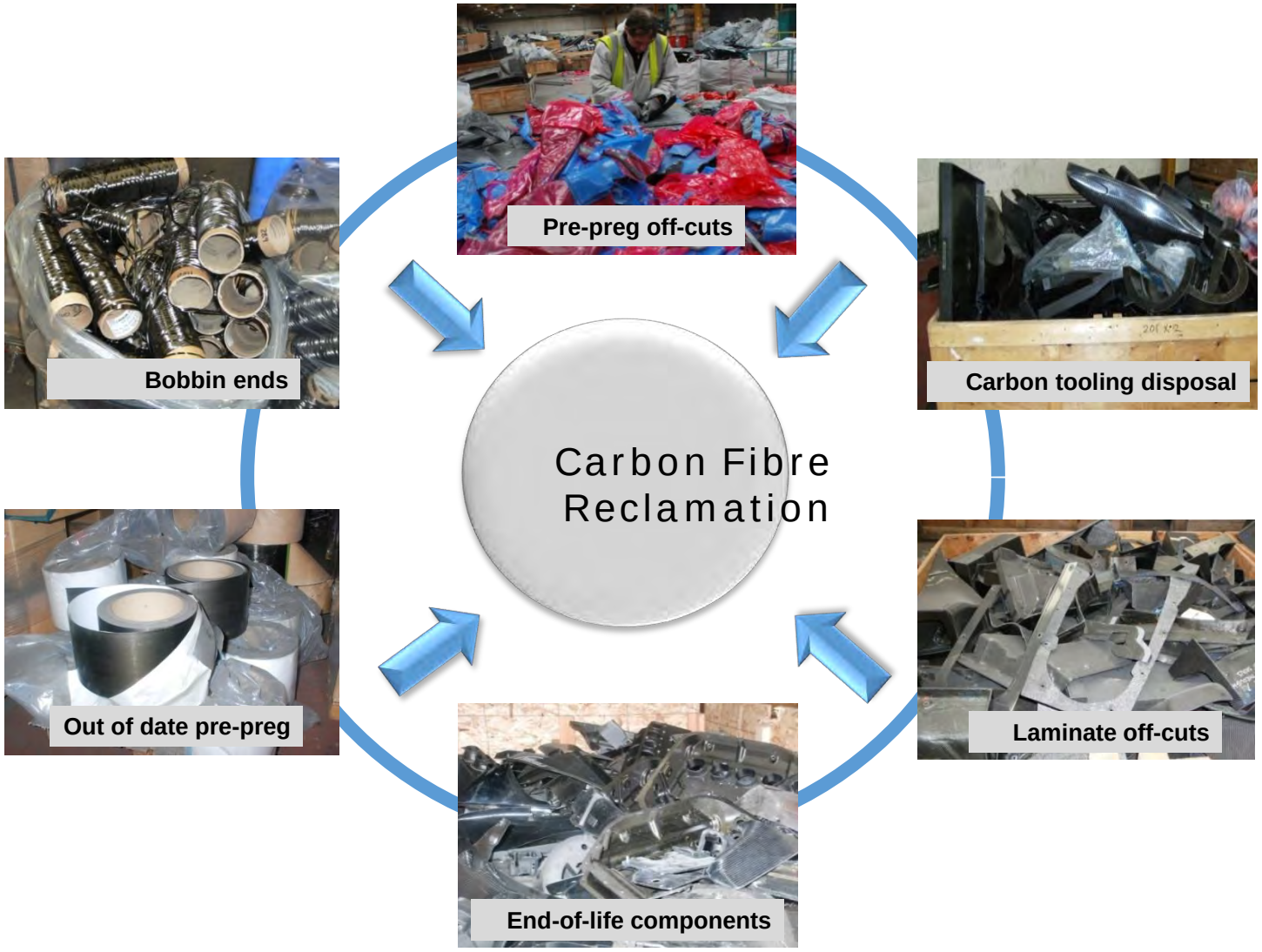
Product Research and Development

- Key for characterizing and validating rCF into new products and applications.

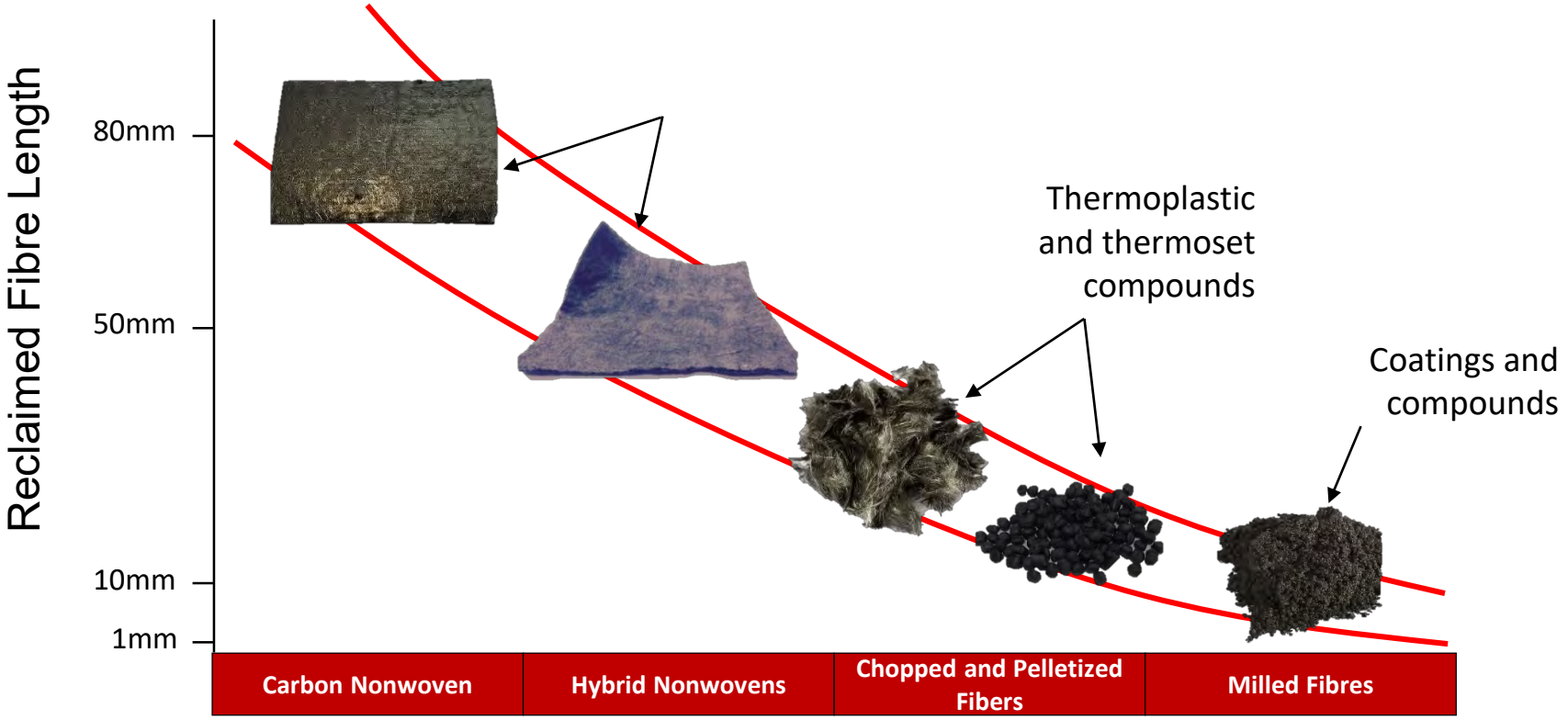

Carding into Non Woven Mats


Chopping / Milling

Types of Scrap ELG Handles:



Focus on products suitable for high volume manufacturing



Carbon Fibre Market Development:

- Primary focus—Transportation—automotive (mostly interested in injection molded parts), truck and rail.
- Early successes from high end automotive and electronics industry using non wovens for composite manufacturing
- Main driver is the need for lightweight to improve efficiency with added strength / toughness.
- Secondary considerations are potential to improve comfort, improve vehicle durability, reduce infrastructure damage.
- There is also an environmental consideration—major OEMs want to reduce, re-use and recycle their msm and migrate to more sustainable materials.

Other markets :

- Additive manufacturing (3D printing, selective laser sintering).
- Composite tooling.
- Electronics.
- Marine, including oil and gas.


Dynamic
Global
Reliable
Strategic Partner
Innovative
Leading
Flexible
Responsible

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