Circular economy in the steel industry

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World Steel Association
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• No discussions on current or future production output or current or future capacity or capacity utilisation involving non-public information, or desired capacity or production output or capacity utilisation levels, or coordinated capacity, capacity utilisation or production output increases or decreases
• No discussions on allocating geographical or product markets or customers or classes of customers
• No discussions on concerted actions involving costs (including concerted actions against suppliers)
• No discussions on future raw material prices, price terms or negotiating strategies
• No discussions regarding how to respond to price increases or other charges from suppliers or whether or how to pass on any costs to customers
• No discussions on contemplated trade actions or complaints about trade flows
• No discussions on non-public company-specific forward looking commercial strategies or plans

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The World Steel Association (worldsteel) is a non-profit organisation.

worldsteel represents steel producers, national and regional steel industry associations, and steel research institutes.

It has headquarters in Brussels, Belgium. A second office in Beijing, China, opened in April 2006.

Members represent around 85% of global steel production.
worldsteel – our key focus areas

worldsteel is active in key areas of interest to the steel industry:

- Automotive
- Climate change and environment
- Communications
- Construction
- Education and training
- Life cycle assessment
- Raw materials
- Safety and health
- Sustainability
- Steel market analysis
- Technology
Circular economy and the steel industry
Influences in the spread of circular economy

Sharing economy
- Concentration of underutilised assets
- Population density
- Trust and culture, regulatory schemes

Reduce
- Efficient transformation
- Design philosophy
- Steel grades, applications, labelling

Reuse
- Low complexity applications
- Technical requirements
- Material durability
- Disassembly challenge

Remanufacturing (refurbish and repair)
- Repair/reconditioning to “as normal” state
- High manual labour requirements
- Uncertainty in deciding optimal capacity
- Changing complexity of reverse logistics

Recycling
- Technical requirements
- Scrap collection
- Scrap sorting
Circular economy impacts steel demand via multiple channels

Impact on steel demand
- Lower steel intensity
- Longer life of steel containing goods
- Reduced demand for steel containing goods
- Lower scrap availability

Impact on raw materials
- Increase scrap supply

Reduce
Reuse
Remanufacture
Recycle

New applications to enable the circular economy

Reuse and remanufacturing extend the service life of steel applications
Circular economy influences all aspects of the industry

Circular economy regulation and consumer behavior

Demand side
- Car sharing, public transport use, sharing of equipment in manufacturing and domestic appliances
- Reduce demand for steel containing goods

Production side
- More efficient use of material
- Remanufacturing and reuse
- Reduction in steel content
- Prolongation of life time of steel containing goods

Recycling
Early estimates on postponed steel demand

In 2021 steel demand is expected to recover to 1,717 Mt, an increase of 3.8% over 2020.

Source: Worldsteel estimates

In 2021 steel demand is expected to recover to 1,717 Mt, an increase of 3.8% over 2020.
Automotive industry remanufacturing
Automotive remanufacturing is a mature industry on the cusp of significant changes. Commonly remanufactured products have high steel content and high steel retention during remanufacturing (85 – 95%). Steel content is expected to decrease with the transition to electric vehicles.

**MARKET OVERVIEW**

2018 value estimated at €8.2 bn

**CURRENT VALUE**

Future remanufacturing activity is estimated to reach between €18.8 and 28.1 bn by 2050

**FUTURE REMANUFACTURING**

- Transition to EV technology
- Increasing OEM engagement with remanufacturing
- Pressure on independent remanufacturers
- Pressure from increase in quality of low cost imports
- Service-based business models, e.g. leasing, car sharing, car hailing are increasing

**MAIN TRENDS**

Source: Study done for worldsteel by Oakdene Hollins
Domestic appliances remanufacturing
Domestic appliances dashboard

**MARKET OVERVIEW**

Domestic appliance remanufacturing is currently a niche activity but has the potential for fast and widespread uptake.

**STEEL CONTENT**

Domestic appliances potentially suitable for remanufacturing are typically about 50% by mass. Remanufacturing at a product-level has a high steel retention at over 95%.

**CURRENT VALUE**

2016 activity of sole domestic appliance remanufacturer identified to date reported at €1.8 m.

**FUTURE REMANUFACTURING**

Future remanufacturing activity is estimated to reach between €1.8 and €2.5 bn by 2050.

**MAIN TRENDS**

- Increasing new entrants exploring circular economy business models
- Increasing circular economy pilot activity from OEMs
- Examples of contracted remanufacturing
- Sole independent domestic appliance remanufacturer identified expanding operations around Europe

Source: Study done for worldsteel by Oakdene Hollins
Heavy duty and off-road remanufacturing
Heavy duty and off-road dashboard

**MARKET OVERVIEW**

Heavy duty and off-road remanufacturing is a mature industry, however there is still potential for growth.

**CURRENT VALUE**

2018 value estimated at € 4.9 bn

**FUTURE REMANUFACTURING**

Future remanufacturing activity is estimated to reach between € 6.8 and 13.2 bn by 2050

**MAIN TRENDS**

- Increasing breadth of OEM engagement with remanufacturing
- Emissions regulations becoming increasingly stringent
- Increasing competition from distributors who dilute connection between OEM remanufacturer and customer
- Lower end equipment not designed for reman

Commonly remanufactured products have high steel content and high steel retention during remanufacturing. Steel content is expected to decrease with the transition to electric vehicles.

Source: Study done for worldsteel by Oakdene Hollins
Mechanical equipment remanufacturing
Mechanical equipment dashboard

**MARKET OVERVIEW**

Mechanical equipment remanufacturing is a mature industry but remains challenging to quantify due to diverse nature of products and terminology.

**CURRENT VALUE**

2018 value estimated at €1.0 bn

**STEEL CONTENT**

Remanufactured equipment has a wide range of steel content values, but generally steel content is expected to be high. Steel retained during remanufacturing would also be expected to be high for the majority of structural elements.

**FUTURE REMANUFACTURING**

Future remanufacturing activity is estimated to reach between €1.4 and 3.1 bn by 2050.

**MAIN TRENDS**

- Business-as-usual practice for the sector
- Overhaul and refurbishment more commonly used terminology
- Remanufacturing linked to general manufacturing industry growth
- New products, e.g. wind turbines, emerging as new remanufacturing markets

Source: Study done for worldsteel by Oakdene Hollins
Impact of product as a service
Market trends - uptake of CE business models

Most product categories have seen growth in the number of enterprises operating in rental and leasing and/or growth in the related turnover. This could indicate an uptake in CE business.

Source: Study done for worldsteel by Oakdene Hollins

<table>
<thead>
<tr>
<th>Product Category</th>
<th>Number of enterprises (%)</th>
<th>Turnover (%)</th>
<th>Gross operating surplus (%)</th>
<th>Gross investment in tangible goods (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cars and light motor vehicles</td>
<td>20</td>
<td>31</td>
<td>46</td>
<td>48</td>
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<tr>
<td>Trucks</td>
<td>26</td>
<td>4*</td>
<td>10*</td>
<td>21*</td>
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<tr>
<td>Personal and household goods</td>
<td>28</td>
<td>33</td>
<td>32</td>
<td>65</td>
</tr>
<tr>
<td>Agricultural machinery and equipment</td>
<td>16</td>
<td>35</td>
<td>70</td>
<td>26</td>
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<tr>
<td>Construction and civil engineering machinery and equipment</td>
<td>1</td>
<td>10</td>
<td>28</td>
<td>58</td>
</tr>
<tr>
<td>Other machinery, equipment and tangible goods n.e.c.</td>
<td>38</td>
<td>6</td>
<td>-12</td>
<td>6</td>
</tr>
</tbody>
</table>

Source: EUROSTAT, Annual detailed enterprise statistics for services (NACE Rev. 2 H-N and S95)
Conclusions

Current status

- The 2018 value of remanufacturing for the four product sectors examined in this analysis is estimated to be €14.2 bn.
- Remanufacturing is currently a small fraction of Circular Economy activity (for example, compared to recycling and reuse), both in value and by steel volume.
- Automotive and HDOR reman activity in 2018 was estimated to retain 483 kt steel.
- While remanufacturing volumes are small, it is generally a high value activity suited to technical products.
- Remanufacturing activity varies from a business-as-usual activity (e.g. the HDOR and industrial equipment sectors) to novel (domestic appliances).
- The remanufacturing industry has adapted to operate in a changing regulatory landscape (e.g. emissions regulations in automotive and HDOR), however, regulatory barriers to remanufacturing still exist (e.g. transboundary shipments of core).
- The remanufacturing concept is not widely known beyond the industry and particularly by the general public.

Source: Study done for worldsteel by Oakdene Hollins
Conclusions

Future potential

- The remanufacturing industry in Europe is set to grow against a backdrop of a changing technical landscape (and product composition)
- The total size of the four remanufacturing sectors examined could grow to between €29 bn and €47 bn by 2050
- The future trajectory of the remanufacturing sector will depend upon remanufacturer’s ability to absorb new products into their operations (e.g. EV components, domestic appliances, wind turbines etc.)
- Regulatory and social trends are anticipated to support the greater acceptance and uptake of remanufacturing, as part of the wider Circular Economy agenda
- Remanufacturing will generally benefit from the uptake of CE business models, especially those moving towards offering products as a service
- Assuming steel retention scales with remanufacturing revenue, an initial estimate of steel retained during remanufacturing in the automotive and HDOR sectors is between 675 kt and 1,360 kt per year, by 2050
- This approximation gives a cumulative volume of retained steel from remanufacturing (between 2018 and 2050) of 20 – 31 Mt

Source: Study done for worldsteel by Oakdene Hollins
Thank you

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