Connecting material stocks to services: The example of steel use in UK vehicles

Jonathan Norman\textsuperscript{a,*}, André Cabrera Serrenho\textsuperscript{b}, Julian Allwood\textsuperscript{b} and Geoffrey Hammond\textsuperscript{a,c}

\textsuperscript{*Email: J.B.Norman@bath.ac.uk}

\textsuperscript{a} Department of Mechanical Engineering, University of Bath, UK
\textsuperscript{b} Department of Engineering, University of Cambridge, UK
\textsuperscript{c} Institute of Sustainable Energy & the Environment (I\textcdot SEE), University of Bath, UK
Why steel, why vehicles, why service?

Steel flows to supply UK demand, 2007
Objectives

- To build a numerical model to understand the relationship between car service and the stocks and flows of materials (especially steel).
- For each key input to examine the effect of different scenarios on material demand.
- To use this to inform further studies, including lessons for energy and emissions policy.
Modelling approach

Service requirement: Passenger-km

Stock required: Passenger cars

New cars required

Material required

Energy and emissions
Stock required to provide service
New cars required

Cumulative new cars 2014-2050

Mean lifetime (years)

BAU stock scenario
Material required

BAU scenarios for stock required and lifetime

Material required

BAU scenarios for stock required and lifetime.

Cumulative material 2014-2050 shown.

Material required

Increased utilisation of stock and maximum vehicle lifetime.

Cumulative material 2014-2050 shown.

What has the biggest effect?

Steel required 2014-2050

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Mt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max scenario</td>
<td>70</td>
</tr>
<tr>
<td>Increased vehicle use</td>
<td>-57%</td>
</tr>
<tr>
<td>Increased vehicle life</td>
<td>-31%</td>
</tr>
<tr>
<td>Material composition change</td>
<td>-54%</td>
</tr>
<tr>
<td>Combined minimum</td>
<td>-82%</td>
</tr>
</tbody>
</table>
What's next?

Primary energy for material production 2014-2050

Age distribution of stock

Current virgin/recycled content

2013

2050 - increased use and max lifetime
Acknowledgements

Grant number: EP/K011774/1
Connecting material stocks to services: The example of steel use in UK vehicles

Jonathan Norman\textsuperscript{a,*}, André Cabrera Serrenho\textsuperscript{b}, Julian Allwood\textsuperscript{b} and Geoffrey Hammond\textsuperscript{a,c}

\textsuperscript{*}Email: J.B.Norman@bath.ac.uk

\textsuperscript{a} Department of Mechanical Engineering, University of Bath, UK
\textsuperscript{b} Department of Engineering, University of Cambridge, UK
\textsuperscript{c} Institute of Sustainable Energy & the Environment (I•SEE), University of Bath, UK