Ecodesign for strategically and effectively managing critical materials
An explorative study in the Wind Power and Renewables division of Siemens AG
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Eco-design for strategically and effectively managing critical materials: An explorative study in the wind power division of Siemens AG

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Problem analysis
Since 1980 the amount of materials extracted and consumed worldwide increased by 60%, totaling 62 billion Mt per year in 2008. Metal ores represented the largest growth in material demand, particularly due to the growing electronics, advanced manufacturing and renewable energy sectors.

The wind industry is expected to account for a significant share of the future energy scenario. Increasing production values, product sizes, and complexity related to the components themselves pose many future challenges to the issue of critical materials.

A company approach to manage critical materials and other product-related aspects
Despite a wind turbines perceived environmental benefit, there are many improvements that can be made at the product design level to improve its environmental performance. Material use is of high relevance particularly because the raw material and manufacturing phases contribute significantly to the environmental impacts in a life cycle perspective. The end-of-life is another life cycle phase that should be considered during product development. Furthermore, recent sources indicate that materials critically frames eco-design as a potential opportunity.

This research forms a part of a three year industrial PhD project about the implementation of eco-design in an organizational context. The case company is the wind power division of Siemens AG, where a number of eco-design activities are simultaneously being tested and implemented. The outcomes of this action based research are expected to contribute to existing literature relating to the “soft-side” of eco-design and how to effectively organize and manage it in daily business practices.

Future insights
This research considers eco-design to be a viable approach to managing critical materials.

- The goal of eco-design is to systematically evaluate and improve a products environmental impacts across its entire life cycle without compromising functionality, cost or quality. The variety of eco-design tools and improvement options lead to its flexible approach.
- The assessment of critical materials via eco-design approaches can aid decision making, optimize material efficiency, reduce business risks and indicate new business opportunities.
- Furthermore, its integration into the PLM process of an organization ensures knowledge is utilized from a variety of expertise (e.g. design, engineering, procurement, etc.)

The table below depicts an estimated breakdown of components and materials used in a wind turbine:

<table>
<thead>
<tr>
<th>Material</th>
<th>% of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blades</td>
<td>20</td>
</tr>
<tr>
<td>Hub</td>
<td>10</td>
</tr>
<tr>
<td>Blades</td>
<td>20</td>
</tr>
<tr>
<td>Blades</td>
<td>10</td>
</tr>
<tr>
<td>Blades</td>
<td>5</td>
</tr>
<tr>
<td>Blades</td>
<td>5</td>
</tr>
</tbody>
</table>

Life Cycle Assessment (LCA) to determine environmental impacts across all product stages

Systematic assessment of critical materials using an evaluation scheme developed by CHR EHS EP PE

Facilitating eco-innovation for a more sustainable product

References
1. OECD. 2013. Materials, productivity and the environment, key findings

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