Steeluniversity.org: A new Internet E-Learning Resource on Sustainability

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A new Internet E-Learning Resource on Sustainability

Overview

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3 Structure of the E-Learning Resource – The Modules
4 The module “Sustainability”
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A new Internet E-Learning Resource on Sustainability

Basis for steeluniversity.org

Need:
Comprehensive tool for knowledge transfer combined with the challenge and fun of a game and realistic simulation of industrial processes

Form:
Freely-available web-based e-learning tool

⇒ www.steeluniversity.org
initiated and developed by IISI

steelmaking
steel products
steel applications
underlying scientific principles
associated sustainability issues
environmental issues
Motivation for an E-Learning Resource on Sustainability
Aims, Objectives & Target Audiences

✓ Recruitment of high calibre graduates into the steel industry
✓ Sustainability of ferrous metallurgy knowledge in academia / industry

✓ Excite students/teachers about steel; enhance image of steel industry
✓ Reduce in-company training costs
✓ Enhance knowledge transfer and collaboration between academia and industry

✓ Undergraduate students, their professors and lecturers
✓ Steel company employees, recent graduate recruits
✓ Researchers and technical experts in academia and steel industry supply chain

University of Stuttgart
Chair of Building Physics (LBP)
Life Cycle Engineering (Gabi)

International Iron and Steel Institute
Structure of steeluniversity.org

The Modules

- Secondary Steelmaking
- Continuous Casting
- Materials Selection for Car Door Panels
- Steels in Construction
- **Sustainability**
In this module there are four sections that deal with:

- Sustainability, Steel and the Environment;
- Principles of Life Cycle Thinking;
- Introduction to Life Cycle Assessment, and
- Applications of Life Cycle Assessment.
What is Sustainability?

Instructions
Drag the numbered circles to their appropriate positions on the triangle. Think carefully about the relative importance to environmental, social and economic factors.

Scoring
You can check your progress at any time by clicking the 'Current score' button below. Labels in the appropriate position will be marked green, those close to the appropriate position will be marked orange, and those incorrectly placed (including those still in their original positions) will be marked red. Each time you click the button, the 'number of attempts' is increased. The aim is to successfully complete the diagram in the lowest number of attempts.

Number of Attempts: 1
What are the main environmental impacts?

The greenhouse potential is calculated in carbon dioxide equivalents, CO2-Eq.

Since the length of stay of a gas in the atmosphere must be included in the calculation, the time horizon under observation must always be given. This is usually given in relation to a 100 years.

In evaluating the greenhouse effect, it should be taken into consideration that the effects are global and of a long duration.
The International Iron and Steel Institute (IISI) has identified 11 indicators of sustainability and is using these to measure the contribution of the steel industry to sustainable development. These are:

- Investment in new processes and products (% turnover)
- Operating income (% turnover)
- Return on Capital Employed (% capital employed)
- Value Added (% total revenue)
- Greenhouse Gas emissions (tonnes CO₂ / tonne of crude steel produced)
- Material Efficiency (%)
- Energy Intensity (GJ / tonne crude steel)
- Steel Recycling(% crude steel produced)
- Environmental Management Systems (% total employees / contractors working in Registered Production Facilities)
- Employee Training (Training Days / employee)
- Lost Time Injury Frequency Rate (Frequency / 1,000,000 hours worked)

steeluniversity.org: The module “Sustainability”
Principles of Life Cycle Thinking

The module about the life cycle of steel products contains:

- Interactive exercises
- Lessons
- Queries
- Tests

1. Compile the life cycle of a car by sorting icons of the life cycle phases in the right order via drag and drop.

2. Fill in the right terms for the recovery of material at the end of the product’s life cycle.

Correct.
Remanufacturing keeps the materials' properties to build something new.


3. **Impact Assessment** evaluates these inputs and outputs from an environmental point of view.

In the graphic click on the elements of an LCA to find out more about the procedure and the individual steps of an environmental Life Cycle Assessment (LCA).

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### Lessons on methodology of Life Cycle Assessment:

- **Goal & Scope**
- **Functional Unit**
- **System Boundaries**
- **Life Cycle Inventory Analysis**
- **Impact Assessment**
- **Interpretation of results**

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### 3. **Life Cycle Impact Assessment**

**Characterisation of environmental impacts**

The classification of elementary flows simply means to group flows with the same qualitative environmental impact.

For global warming it means that all emissions contributing to this environmental effect are grouped, e.g., carbon dioxide, methane, laughing gas (nitrogen oxides), etc.

The **characterization** step within the impact assessment involves the quantification of the emission’s possible impacts. This is done in order to achieve one indicator for one impact category (e.g., Global Warming Potential, GWP) by summing the total potential impact.

**Enter the answers for:**

1. What is the GWP characterisation factor for NO₂?

2. What is the EP characterisation factor for ammonia?

3. What is the POCP characterisation factor for CH₄?
of a Car: Consequences of Material Selection Decisions

An example of how effective changing the material can be in reducing the environmental impact of a car is the use of higher strength steel to reduce the weight of a car, thereby reducing fuel consumption and hence the emission of greenhouse gases and the production of the resource of oil.

steeluniversity.org: The module "Sustainability" Applications of Life Cycle Assessment

Examples from and exercises on steel, automotive and construction materials used and the performance characteristics of each car are:

<table>
<thead>
<tr>
<th>Materials / kg</th>
<th>Conventional</th>
<th>ULSAB AVC</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>91.24</td>
<td>40.75</td>
</tr>
<tr>
<td>Iron</td>
<td>154.13</td>
<td>55.32</td>
</tr>
<tr>
<td>Ferrous Metals</td>
<td>127.32</td>
<td>64.77</td>
</tr>
<tr>
<td>St</td>
<td>150.02</td>
<td>126.55</td>
</tr>
<tr>
<td>Materials</td>
<td>180.60</td>
<td>123.37</td>
</tr>
<tr>
<td>Weight</td>
<td>1553.69</td>
<td>997.96</td>
</tr>
</tbody>
</table>

Vehicle, km
- Petrol: 193,000
- Petrol consumption: 10.3
- Petrol consumption per km: 4.5
- Doors: 4+4
- Passengers: 5
- Acceleration time to 100 km/h: 10.7

LCA of a Building - Phase 2: Life Cycle Inventory

<table>
<thead>
<tr>
<th>Years</th>
<th>Energy, GJ m⁻²</th>
<th>CO₂ Emissions, kg m⁻²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>10</td>
<td>2.6</td>
<td>255</td>
</tr>
<tr>
<td>20</td>
<td>5.6</td>
<td>525</td>
</tr>
<tr>
<td>30</td>
<td>12.8</td>
<td>755</td>
</tr>
<tr>
<td>40</td>
<td>24.8</td>
<td>985</td>
</tr>
<tr>
<td>50</td>
<td>49.6</td>
<td>1215</td>
</tr>
<tr>
<td>60</td>
<td>99.2</td>
<td>1445</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Energy, GJ m⁻²</th>
<th>CO₂ Emissions, kg m⁻²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slim-floor</td>
<td></td>
</tr>
<tr>
<td>Structure Embodied</td>
<td>3.6</td>
</tr>
<tr>
<td>Other Embodied</td>
<td>6.2</td>
</tr>
<tr>
<td>Lighting and low power</td>
<td>0</td>
</tr>
<tr>
<td>Heating and Ventilation</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>8.8</td>
</tr>
</tbody>
</table>
steeluniversity.org: The module “Sustainability”

Conclusions

steeluniversity.org is intended to…

- Inform and inspire students, teachers and steel industry employees to better understand the issues around sustainability
- Encourage them to conduct Life Cycle Assessments
- Provide information on relevant environmental effects and impacts causing these impacts in general
- Provide valuable in-service training and life-long learning for employees in the steel industry supply chain at reduced cost
- Facilitate research partnerships between academic and steel industry experts
- Demonstrate the commitment and contribution of the steel industry to a sustainable world and to the knowledge economy
Switzerland, September 25-27th 2004

“Innovative and Excellent Graphical Simulations, Open-Ended Problems and Integrated Educational Approach”
Visit steeluniversity.org and learn about sustainability…

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