Teaching of Life Cycle Assessment methodology to sensitize future engineers to sustainable development

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Introduction

- What are the required skills to become an effective engineer?
  - Being able to solve technical problems, taking into account societal challenges

- Is SD part of the required skills?
Introduction

Major global challenges of today

Source = S. Valdivia
Introduction

- Global warming

- Local air pollution
  - Acidic rains, smog, particulate matters, …

- Natural resources depletion
  - Oil shocks, rare earths, ‘critical raw materials’

- Accidental pollutions
  - Tchernobyl, Seveso, Bhopal, etc.

Impacts to take into account for Environment and Humans
Introduction

- Increasing importance of environment
  - Pressure of industries
  - Everyday life problems

- How to deal with environment and how to solve problems?
Environment and engineers at ULg

- Bachelor level
  - Mandatory course ‘introduction to environmental engineering’
  - Sustainable energy

- Master level (Chemical engineering)
  - Lectures relative to
    - Downstream processes
      - Treatment of air and water pollution
  - Until three years ago
    - Green chemistry
    - Ecodesign
    - LCA
Standard definition of LCA

- General frame given by International Standards ISO 14040 et ISO 14044
  - « studies environmental aspects and potential impacts through the whole life of a product, from raw materials extraction to its production, its use, and its final disposal »
  - Product = product, activity, system or process

http://3.bp.blogspot.com/-ZcKjWhyEMEw/VVCkBSjfiFI/AAAAAAAAANQ/kqCx0pkCnDg/s1600/LCA_new.png
Introduction of LCA courses at ULg

- Since 2006
  - 2 hours given to bachelors in engineering

- Since 2013
  - Elective courses « LCA and ecodesign »
    - Proposed to student in second master of chemical or mechanical engineers
  - Mandatory course for industriel engineers (HELMO-Gramme)
  - Based on LCA research for more than 15 years at ULg
  - Not so well considered at first: « LCA is just a ‘push button’, putting data in software, not reliable, no interest, … »
LCA and Ecodesign course in Liège

- Integrated course based on
  - Previously acquired knowledge (‘pre-requisites’)
    - Mass and energy balances
    - Treatment of air pollution
    - Wastewater treatment
    - + Physical unit operations, reactor engineering, process modelling …
LCA and Ecodesign course in Liège

- Divided in three parts
  - Learning
  - Practising
  - Acting and opening their mind
Learning

- Goal: to highlight main environmental challenges
  - For their generation
  - For the next ones

Actions:

- Discussions with students about environmental challenges
- Explanations of current regulations and environmental context
LCA course in Liège

- Practising
  - Learning of LCA through ISO standards
    - Exercises
      - Comparison of PS and popcorn to fill a box (Jolliet et al. 2010)
  - Published studies
  - Illustrations of green washing
    - Importance of LCA to avoid trade off in steps or pollution

- Actions:
  - Homework with the critical review of a published article
    - Environmental relevance
LCA course in Liège

Practising

Actions:

- To model scenarios with a LCA software
- To show the only interface function of the tool
  - Trash in, trash out...
- To train their critical mind
- Same exercises for all students with the help of the teachers
LCA course in Liège

- Acting and opening their mind
  - Group project
    - One scientific paper to analyse and model per group (different from one another)
    - Work together
  - Critizise the paper
    - Environmental relevance and accordance or not with ISO standards
  - Remodel/rebuilt scenarios
  - Comparison of their results with the published ones
    - Differences
    - Interpretation
Conclusions and perspectives

- **LCA course**
  - First attempt to add
    - Sustainability competences
    - Upstream method linked to environment
  - Improvement each year
    - Feedback of students
    - Feeling of teachers
    - Reduction of time dedicated to the modelling work
    - Increase of time dedicated to interpretation
Conclusions and perspectives

- LCA course
  - Main goal
    - To act against greenwashing
    - To increase transparency
  - Main drawback
    - Lack of social and economic inputs
  - Perspective
    - Add social and economic fields with the help of colleagues from other faculties
    - Association with integrated/interdisciplinary project of 1st master
    - Now proposed to some bioengineers
Thanks for your attention! Any question?

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