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

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PEPs
CHEMICAL ENGINEERING

Université de Liège

Introduction

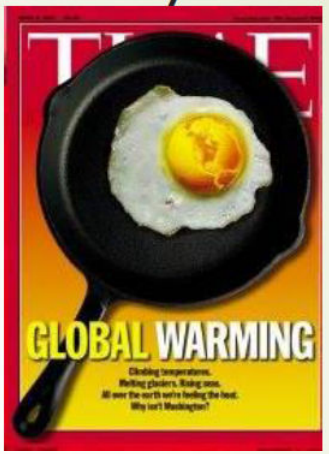
- What are the required skills to become an effective engineer?
  - Being able to solve technical problems, taking into account societal challenges

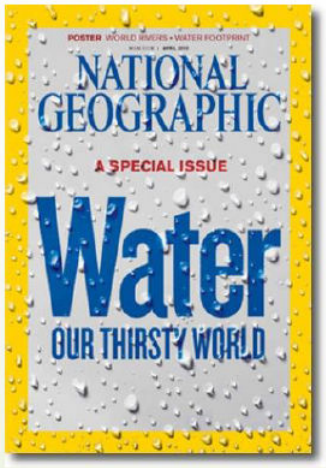
- Is SD part of the required skills ?

Introduction

Source = S. Valdivia

Major global challenges of today





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

LCA and Ecodesign course in Liège

- 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
    - Exercices
      - 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 exercices 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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