Integration of sustainability and LCA in engineering education at DTU

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- Education, research, service of authorities, and innovation in technical sciences and engineering
- 20 departments
- 4500 employees more than half of them researchers
- 7000 bachelor and master students
- App. 700 international students per year
Background

- Vision that sustainability is taken seriously in both research and education
  - “DTU’s approach to sustainability must be broad, scientifically well-founded and operational. In particular we should contribute to being able to objectively assess which of two solutions is the most sustainable – and to this being an ability that is nurtured in all engineering students” (DTU President, 2012)
- According to DTU’s strategy for 2014-2019: “DTU’s study programmes will be designed to ensure that sustainability is an integrated part of all programs.”
- Concrete initiatives:
  - Green competition – a pan-university competition on environmentally sustainable projects (until now every 2. year but in the future every year)
  - “Blue dot projects” (e.g. solar decathlon, Shell eco marathon)
  - A range of courses at specific discipline areas
  - “Teach the teachers” programme – yet to be initiated
  - A “DTU Sustain” conference to raise awareness amongst researchers and teachers, initiates 2014
Nurturing sustainability mindset in the students

• A questionnaire study from Aarhus University incl 4000 danish engineering students showed that students in their first year have bad conscience about the engineers role since they connect technology and technological development with pollution and CO2-emissions.
• After the first year they do not consider sustainability in particular.
• Conclusion is that the students are not sufficiently taught about the sustainability challenges their engineering competences can help solve
• And that engineering students loose interest/awareness of sustainability issues during their studies

• How to address the vision of DTU if engineering students loose interest?

• Need to know from the very start that they are not only part of the problems but they also hold a key to the solutions
Our Approach

1. Teaching in methods and tools for sustainability assessment targeted at the different technological domains at DTU, providing a **background education** for students aiming to work with the development of technical solutions and therefore wishing a knowledge of the tools available to assess sustainability of technologies

2. **Specialized teaching and education** in principles and methods for sustainability assessment targeted at the student pursuing a professional career within the field

- Progression of learning is illustrated in the next slides
1 module in "engineering practices in..." (Intro to SD and SD in that specific technology area)

Sustainability in Engineering solutions (Specific tools to assess and implement sustainability) 3 week course in June 5 ECTS

Modules on relevant courses on all studylines, (assessing specific sustainability issues in the technology area) <2 ECTS

Two modules on SD in IFVT < 1 ECTS Focus social and societal dimensions

Sust. Development of emerging tech, 5 ECTS

Modules on relevant courses on selected technology areas, < 2 ECTS
Sustainability expert

Technology specialists

1 module in "engineering practices in..." (intro to SD and SD in that specific technology area)

Sustainability in Engineering solutions (specific tools to assess and implement sustainability) 3 week course in June 5 ECTS

Modules on relevant courses on all studylines, (assessing specific sustainability issues in the technology area) <2 ECTS

Sustainability tools in industry 10 ECTS

Two modules on SD in IFVT < 1 ECTS
Focus social and societal dimensions

Life Cycle Assessment, basic 10 ECTS

Inventory modelling for products and systems. 5 ECTS

Environmental Impact assessment modelling for products and systems. 5 ECTS

Life cycle management 5 ECTS

Semester

1
2
3
4
5
6
7
8
9
10
Process for integration of sustainability teaching

1. Dialogue with the deans for education and with the study leaders
   a. Definition of “learning outcomes” in the sustainability field
   b. Discussion on strategy to reach the learning outcomes
2. Dialogue (possibly workshop) with study leaders
3. Dialogue (possibly workshop) with the relevant teachers
Examples of challenges of embedding sustainability into the curriculum

1. Should the teaching in sustainability be integrated in several basic courses at each study line or can it be taught in a single dedicated course?

2. If integrated: How is it ensured that teachers acquire the necessary sustainability competences?

3. If a single course: What are the challenges of teaching students from several different study lines in the same course?

4. Which pedagogical principles should be used?
Integration vs. Add-on to technical courses

- Fully packed curricula with fundamental engineering skills
- Sustainability considered a “soft skill” (“lower the level of the course”)
- Academic and engineering culture relatively resistant to sustainability integration
  - At DTU openings are seen especially at civil engineering and mechanical engineering

- Dedicated courses runs the risk that sustainability is not embedded in engineering solutions beyond the course
Thank you for your attention

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