How to Include *Sustainability* in Engineering Education?
– The "Green Challenge" at DTU is one way

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Introduction
Sustainability and climate change are high on the global agenda. In the wake of the United Nations Climate Change conference in Copenhagen in December 2009 there seems to be more disagreement and obstacles than concord and solutions, partly because of political and economic sectional interests.

Besides the need for a political agreement on how to meet the climate change challenge the development of new technical solutions is required. Engineers will play a pivotal role in the transition towards a sustainable society [1]. Future engineers must be capable of developing new ideas and solutions on how to turn the tide on the global challenges. An important goal in engineering educations is, then, to ensure that all students will achieve the ability to formulate sustainable solutions. To a certain degree this is done already in education programs at the Technical University of Denmark (DTU), but in order to be able to lead the field and set the spotlight on sustainability DTU has launched GRØN DYST (Green Challenge) – a study conference for DTU students on sustainability, climate technology and the environment which is to be held at DTU June 25, 2010 (web site in Danish: groendyst.dtu.dk)

Setting the Scene
Global warming and man-made climate changes have been part of public debate for several years. In 2008, the Technical University of Denmark (DTU) established the program DTU Climate Change Technologies [2]. The purpose was to develop and strengthen DTUs contribution to solving the climate challenge during the next decades, hence ensuring that DTU will contribute significantly to developing and implementing new solutions related to climate change. The initiative culminated in the DTU Climate Change Technologies Conference held at DTU on September 17, 2009.

The findings from the DTU Climate Change Technologies Conference – compiled on the basis of ten workshops with representatives from science, business and public authorities as well as the conference itself – cover fields of technology related to mitigation, impact assessment and adaption. Each workshop gave an overview of a specific field and outlined recommendations on specific types of technology. The DTU Climate Change Technologies Conference addressed cross-cutting issues and made broader recommendations and deployment of climate change technologies. DTU published the results in a conference paper [2] which was a submitted to the UN Climate Change Conference 2009.

With this initiative DTU is striving to lead the field with regard to research by developing and deploying climate change technologies. When it comes to education DTU programs have incorporated sustainability, climate technology, and environmental issues for a very long time. In

order to enhance this dimension in all programs, DTU has launched the study conference Green Challenge addressing these matters.

Green Challenge at DTU

There are various ways to enhance aspects of sustainability and climate technology in engineering education. One way is to simply add a "green" course to the curriculum. However this does not seem to be the best way to do it. There should be no single course in any program having a monopoly for addressing sustainability, since the best way to ensure student learning is when they work actively with open problems in interdisciplinary projects [3], [4], [5], [6]. A better and more effective way forward is, then, to make sure, that sustainability permeates the whole program, in other words that all courses ideally should incorporate sustainability and climate technology. Or put more precisely: it should be more or less impossible for the students to avoid these aspects in most or even in all courses. This strategy is in accordance with the CDIO philosophy in general [5] as well as the way DTU has implemented CDIO [7]. In this way it is ensured that the students are learning for problem solving and that they not just "know about" sustainability but also "know how" to produce sustainable solutions [1].

Green Challenge brings this forward as a new and innovative way of challenging the students academically. During the spring of 2010 the students will think out new ways. Based on their own ideas, they will then develop a project in collaboration with lecturers and fellow students. And finally they will present their project and results for fellow students, teachers, representatives from industry and representatives from the political sphere on a study conference at DTU. The actual conference provides the students with the unique opportunity to present their project to potential employers and, at the same time, contribute to sustaining academic as well as political momentum with regard to meeting the climate change challenges.

Green Challenge is based on two principles. 1) It is voluntary, which means that no student is forced to participate. 2) It is not based on extracurricular activity for the student , which means that students upon their own reflection should incorporate a participation in Green Challenge into their courses and study programs. The student administration department has purposefully set up means to facilitate this – but not to arrange it for the students. Several cash awards have been sponsored for the Green Challenge conference (total prize sum is $ 20,000) as well as other prizes (e.g. tickets the Roskilde Festival). Finally, student participation in Green Challenge also includes a free ticket to a rock concert at the DTU campus in the evening of June 25 with the very popular Danish band "DAD". To sum it up, Green Challenge is based on a lot of "carrot" – but no "stick2.

Green challenge in a nutshell

Green Challenge was kick-started at a kick off seminar for teachers at DTU with various inspirational presentations and a workshop aiming at generating ideas on how to incorporate sustainability, climate technology, and environmental issues in existing courses. Afterwards students and faculty have been thoroughly informed in numerous ways.

In order to support the idea development, a match making workshop was arranged. All departments had a small stand where they presented ideas for projects, and there was a student corner, where students could advertise for projects or other students. Thus, the Matchmaking Workshop offered the opportunity to meet students and supervisors across study programmes and departments. As a supplement to the match making workshop there is a virtual matchmaking service (a matchmaking wiki at the green challenge website) and a physical students corner in the library, where students are given the opportunity to advertise their projects and to get in touch with other students or teachers.

The students can choose to attend the conference in one of three different categories: poster session, laptop session or free style session. Whereas the first two categories probably will be well known for the reader, the latter might need a bit of explanation. The free style session allows students to present their projects and results in any way other way than the above mentioned. Anything goes! It could be a shout out, a theater performance, an exhibition of artifacts, a video show – you name it! There are no limits. The student's imagination is the only constraint. Hopefully many students will choose this category to present their projects and results in creative – or maybe even sustainable ways.

Experiences so far – and Expectations

At the time being (end of May 2010) we have no overview of how many students will attend the conference. The students are busy preparing for their exams at the end of May, but the word is that many students consider attending with a project. The project Green Challenge initiated after the disappointing Copenhagen meeting in December 2009, which gives a relative short time span for preparation. Hence information to students and teachers about the project have been intense and – maybe a little hectic. The authors look forward to report in more detail at the conference in Montreal in June 2010.

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