Learning Sustainable Development at Chalmers University of Technology

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History

- Early decision to have an compulsory SD course in all programs
- …and to make it possible to choose a SD track at the end of all programs
- Centre for Environment and Sustainability was created 1989 (network of 400 scientists)
- Chalmers Environmental Initiative was launched 1999 (€10 000 000)
- Chalmers member of Alliance of Global Sustainability (AGS) since 2001
- The UNESCO/ESD reform project 2006-2009

Chalmers and Göteborg University

Cooperation via GMV - Centre for Environment and Sustainability

about 50,000 students
2,500 faculty and PhD students
3,000 staff

10,600 students
1,600 faculty and PhD students
800 staff

GMV was created 1989. It is:

- a **network** of 400 environmental scientists from Göteborg University and Chalmers University of Technology, Göteborg.
- a **joint venture** between Chalmers and Göteborg University
- a **meeting point** for activities.
- a **platform for projects**.

Conferences on ESD

- Knowledge and learning for a sustainable society
  Göteborg, Sweden, 12-14 June, 2001 (EU summit)

- Learning to Change our World
  International consultation on education for sustainable development
  Göteborg, Sweden, 4-7 May 2004 (after WSSD in Jo-burg)

- Learning for sustainable development
  Göteborg, Sweden, 2008

- Engineering Education for Sustainable Development (EESD)
  Göteborg, Sweden, 2010

Work-shops on ESD

- **Drivers and Barriers for Implementing Learning for Sustainable Development in Higher Education**
  7-9 december 2005. Organised by: Centre for environment and sustainability in Göteborg

- **Drivers and Barriers for Learning for Sustainable Development in Pre-School, School and Teacher Education**
  27-29 mars 2006. Organised by: Göteborg University and City of Göteborg:

- **The role of early childhood education in a sustainable society**
  2-4 May 2007. Organised by: Göteborg University and City of Göteborg:

- **Right to Knowledge**
  11-14 October 2007. Organised by: Göteborg University, Adult education organisations and Museum of world culture.

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How can sustainable development (SD) be understood?

- SD cannot be exactly defined — and it should not! It is an ever evolving concept. It can be compared with the concept of health. How are you? How are we?

- Education for sustainable development (ESD) is a learning process not a product!

- However, the fact that the present trends are far from sustainable makes it much easier to define unsustainable trends than sustainability.

Sustainable development bring many challenges to the universities:

- To developing students' qualities to cope with uncertainty, poorly defined situations, diverging norms, values, interests and reality constructions.

- To make transformative learning to take place. This means looking at sustainability issues from a range of:
    - disciplinary angles,
    - cultural perspectives,
    - different time perspectives and
    - spatial perspectives.

- To deal with attitudes and values (which are largely hidden), which have shown to be as important challenges for the university as achieving knowledge and understanding.

How does the traditional discipline-based structuring of knowledge and research effect the implementation of learning for sustainable development in higher education?

- It must be hard to find something more multi- and transdisciplinary than sustainable development.
- It is also quite clear that the traditional discipline-based structuring of knowledge and research are here to stay.
- This combination constitute a major challenge for the universities when implementing learning for sustainable development in higher education.
- A common experience from proactive universities is that some kind of organisation with overview and responsibility outside and across the traditional disciplines is essential.

Separate courses and programmes or/and an integrated perspective throughout the whole education?

- The answer is simple: both are needed!
- The separate course is needed to give the basic understanding of the challenges associated with sustainable development; to deliver tools and conceptual models for dealing with dynamic and complex systems; and to attain a feeling of how things are interconnected.
- Since ESD is about continuous learning it is also essential to integrate sustainable development aspects into existing traditional courses.

What role does research for sustainable development have in the process of crossing barriers and creating drivers for education for sustainable development at a university level?

- SD involves a profound transformation of the societal metabolism. This is all a large societal learning process.

- It is therefore difficult to separate research for SD from ESD and both are needed.

- Since the research often determines the structuring of knowledge and research are organised in traditional disciplines “drainpipes”. ESD calls for “gutters”, and therefore new structuring of knowledge. ESD also calls for dissemination of findings — re-writing.

Education for Sustainable Development at Chalmers

- **Welcome of all students each year with 1 hour presentation on Sustainable development**
- **Compulsory courses** (5 full weeks study) for all Chalmers engineers and architects.
- **5 International Master Programs** with focus on Sustainable Development at Chalmers.
- **A wide variety of courses and individual work** via research initiatives and cooperation.
- **PhD schools**
- **Education via research initiatives** as Atmosphere science, Chalmers Environmental Initiative, Alliance for Global Sustainability etcetera.

The ESD reform project

A reform project during 2006-2009,
connected to a UNESCO-chair (John Holmberg)
in Education for Sustainable Development, ESD

http://www.chalmers.se/gmv/SV/projekt/esd_chalmers
Webb pages are in English

The 9 action lines of the ESD project

To develop, in three years, an organization that:

- Guarantees and continuously enhances quality of SD content in courses in Chalmers basic courses in SD (compulsory 7,5 ECTS).
- Guarantees and continuously enhances quality of SD content in other courses.
- Gives effective support to those who order SD courses.
- Gives effective support to students when choosing SD courses.
- Gives effective internal and external information about ESD.
- Gives effective cooperation with internal and external (especially Göteborg University) stakeholders within ESD.
- Gives a forum (physical/virtual) to meet for students and for teachers with interests in the area.
- Supports education of non-teaching personnel within the SD area.
- Supports the development of a campus reflecting Chalmers initiative for SD.

Project leader John Holmberg; Coordinator Marie Arehag

http://www.chalmers.se/gmv/SV/projekt/esd_chalmers

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Inventory
Learning outcomes
Resource group
Positive examples

Project leader: Jörgen Holmberg; Coordinator Marie Arehag
http://www.chalmers.se/gmv/SV/projekt/esd_chalmers

Desired content of compulsory courses on E & SD (document developed by teachers)

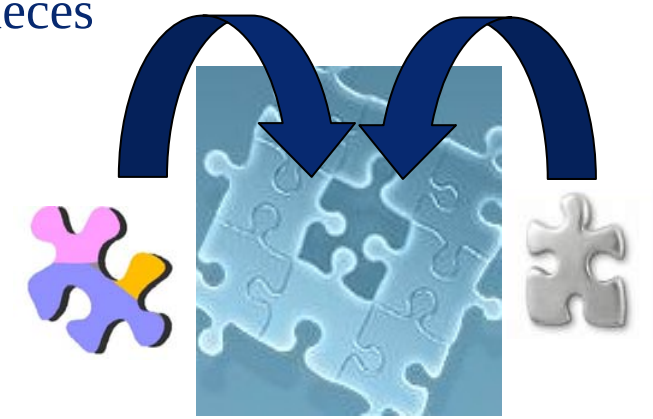
A. The concept
History
Definitions
Ethical incentives
Dimensions
Communication

B. Problems; causes and measures
Status and trends
Critical problems
Systemic thinking
Methods, models
Measures, strategies
Drivers and barriers

C. The professional role
Change in SD context
Individual responsibility
Opportunities

To stimulate systemic thinking

- Show the whole picture (puzzle) – makes it easier to find/design the pieces



  - cause-effect chains
  - product life cycles
  - material and energy flows in the larger system

- Models that describe how the relevant system can be divided into different parts and how the parts fit together – for structuring knowledge, analysing the system, finding problems and measures

Systemic model:

Total impact | Technology factors | 'Well-being' | Population

$$\underset{1/2x}{I} = \underset{x1/20}{i} \cdot m \cdot \underset{5x}{u} \cdot \underset{2x}{P}$$

Impact

Impact per material and energy flow [impact/kg]

Material and energy flow per utility or service [kg/utility]

Utility or service per capita [utility/capita]

Population [capita]

Dematerialisation

Transmaterialisation

Smart engineering

Change lifestyle; consumption patterns

Limit increase

Holmberg, J. and Karlsson, S., 1999. On the Factor X concept from a Sustainability Perspective. Dematerialization and Factor 10. (AFR-report 240, Swedish Waste Research Council, Stockholm).

Dematerialisation strategies

Less material

Less energy

Cleans at 30°

Recycle material

50 bottles

Replace product with service

Multifunctionality

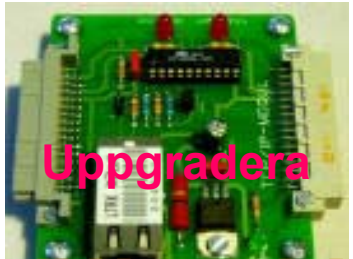
Halmstads bilpool

Co-utilise

Reuse

Mend

Prolong use



Uppgradera

Build in modules

Less hazardous

More natural

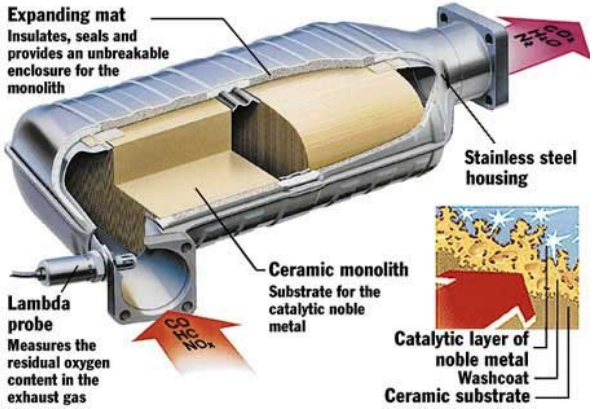
More biodegradable

Lighter material

Transmaterialisation strategies

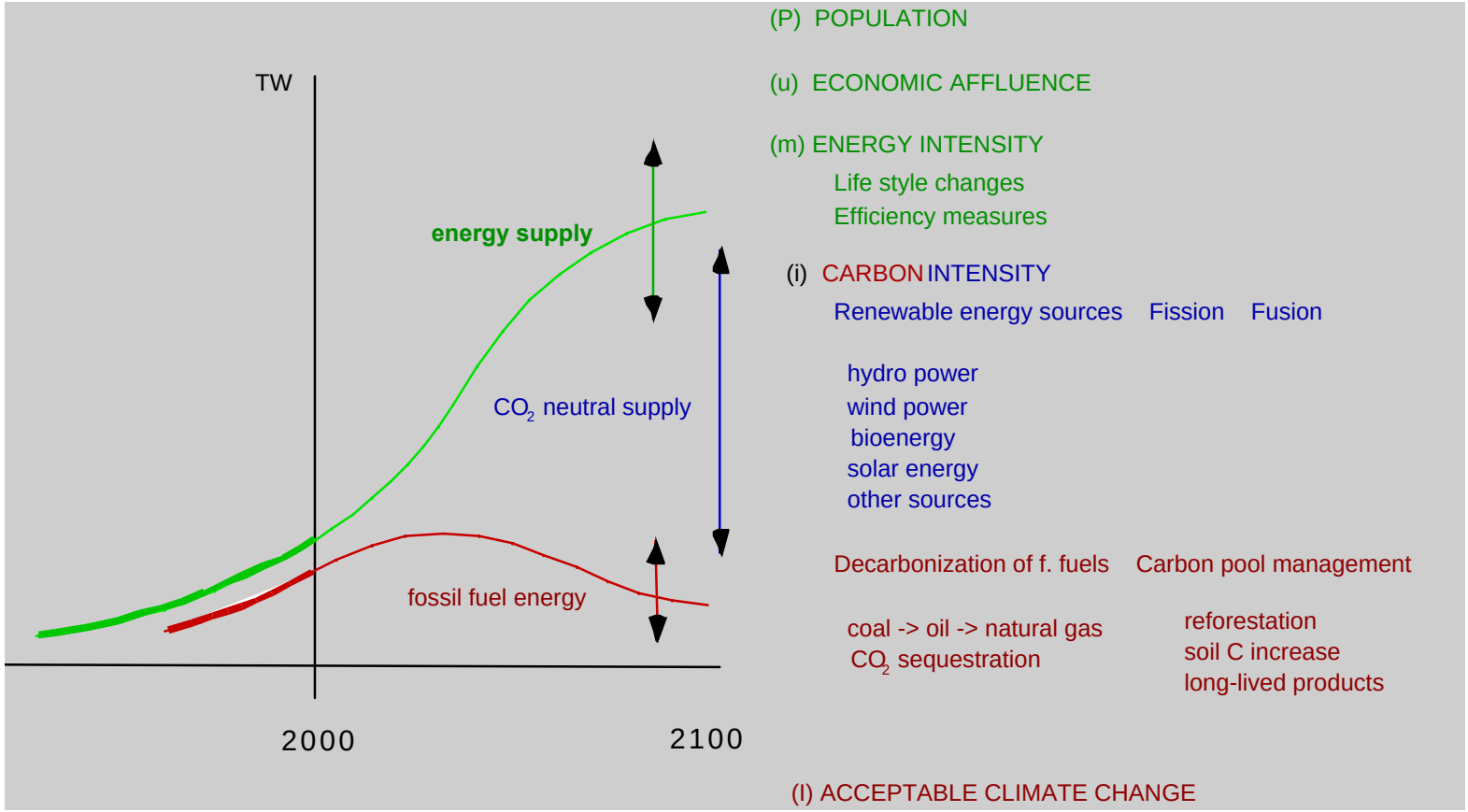
Renewable

End-of pipe technologies



More abundant

Future Energy Options



Karlsson 2006

Lessons learnt

- Consistent and durable commitment from the University management
- Key actors in departments with research and teaching
- Some body/organisation should have the main responsibility
- Constant quality enhancement
- Cater on parallel processes of change
- Give recognition and invitation to all parties to contribute