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# Designers/engineers and sustainable development

VISIONS, STRATEGY AND THE FIRST STEPS BY A UNIVERSITY  
ENGINEERING DEPARTMENT

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Help!

# Vision at the highest level and the role of designers and engineers

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Our vision at the highest level is that we will not get a too painful transition to a sustainable development.

We think designers/engineers are important for such a transition if they have the basic knowledge in sustainability.

So we think **all** designers and engineers must have basic knowledge. But how can we achieve that?

# Who is most important?

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I have to point out that I do not mean that designers and engineers are the most important groups for success. They need the basic knowledge and they need the ability to work with experts from many disciplines and with politicians and administrators. Those groups are at least as important as the designers and the engineers. But I claim that designers and engineers have a unique task to increase the probability for success and, if we are successful with SD, make the transition less painful!

Maybe the decision-makers (or those preparing the decisions) are most important?

Maybe experts and those who through research generate new knowledge are most important?

Maybe all are equally important? Weak links should be avoided.

# So how could you help? Examples

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- Improve our local efforts. What is the right knowledge?
- Give ideas on how to reach all designers and engineers.
- Cooperate with engineers and designers either you are experts, scientists or administrators
- Do research to improve our knowledge about what knowledge is most “right”.

# My agenda today

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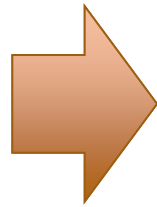
- First I will argue for
  - that designers and engineers are important and unique resources if we strive for SD
  - and we do.
  - that **all** students at schools/universities for design and engineering must get good training in SD.
- Then I will tell you about how we at our department are trying to do our part to achieve that all students taking courses at our department should get a good basic training in SD. In order to do that I have to start this point with some words about our department and university.

I have spare pictures I hope I don't get time to show thanks to your questions and comments, so please feel free to participate.

# Does the following make sense to you?

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The former and the more effective we transform our society to a sustainable society the



... easier it will be – we in the “developed” part of the world have to change our life-styles  
... less negative climate effects  
... more ethical it is (Inclusive, equal, ... )  
... less conflicts  
... less risk for disastrous conflicts

Affordable options in line with sustainable development will make it easier for government to take decisions and industry to invest on sustainable alternatives. Designers/engineers have an unique and important role.



# From Article 10 in the Paris agreement

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- 1. Parties share a long-term vision on the importance of fully **realizing technology development and transfer** in order to **improve resilience to climate change** and to reduce greenhouse gas emissions.
- 2. Parties, noting the importance of technology for the implementation of mitigation and adaptation actions under this Agreement and recognizing existing technology deployment and dissemination efforts, shall **strengthen cooperative action on technology development and transfer**.
- Et cetera

My talk is about an important way to strengthen cooperative action on technology development and transfer

And not only to improve (to achieve) resilience to climate change but achieve social, economic and environmental sustainability

Do we know that climate effects of our activities is the biggest threat to our children, grandchildren a.s.o.

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No, I don't think so. What do you think?

But we know that the three pillars  
(social, economic and environmental)  
are connected in a complex system.



# Designers/engineers could contribute to a less painful transition to a sustainable world.

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Product development  
Process development  
Architects  
Design of infrastructure  
Et cetera  
as  
Designers/engineers  
Leaders/managers  
Politicians  
Researchers  
Teachers

They have unique knowledge to see hazards in what is developed in advance

They have unique knowledge to see possibilities

If they have a basic knowledge in how our complex world is functioning and have the ability and willingness to co-operate with experts.

Small steps (continuous improvements)

Radical changes (reengineering)

Which way is best?

What is possible in our societies?

**But are our universities giving the D/E the basic knowledge?**



# Designers/engineers could contribute to a less painful transition to a sustainable world.

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We can't know beforehand which engineers that will get into situations where they can make a smaller or bigger difference for SD. But most will.

Thus **all** designers/engineers must get good basic knowledge for sustainable development.

HOW?

# Lund university

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- Founded in 1666
- 41 000 students (individuals/year)
- 7 500 employees
  - 800 professors
  - 4 200 lecturers/researchers and doctoral students
- Turnover EUR 800 million
  - 1/3 education, 2/3 research

# A comprehensive university – 8 faculties

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- Medicine
- Engineering
- Science
- Social Sciences
- Humanities and Theology
- Economics and Management
- Law
- Fine and Performing Arts (Music, Theatre, Fine Art)



# LU Sustainability Forum:

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“develops, promotes and supports exchange within the University and between the University and society in the field of sustainability, including climate, energy, ecosystem services, water issues, efficient resource management and sustainable community development”; and “strengthens Lund University as an incubator for innovation, green leadership and entrepreneurship”, et cetera.

# Other major SD resources at Lund University

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- Lund University Centre for Sustainability Studies, LUCSUS;
- The Centre for Environmental and Climate Research, CEC;
- The International Institute for Industrial Environmental Economics, IIIEE and
- The Environmental and Energy Systems Studies, which is a division of the Department of Technology and Society at Lund Institute of Technology, but was established in 1969 as the Environmental Studies Programme at Lund University.
- And more

# Faculty of Engineering

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- **Education**
- 16 five-year engineering programmes
- 5 three-year engineering programmes
- 13 international Master's programmes
- Programmes in Architecture and Industrial Design
- Fire Protection Engineering programme
- Risk Management Engineering programme
- Three-year Food Technology programme

Approx. 9 600 students  
Approx. 1,500 employees

# Department of Design Sciences

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Belongs to faculty of engineering at Lund university

Over 100 employees

- Ergonomics and Aerosol technology; (incl Working environment)
- Industrial design
- Innovation engineering
- Packaging logistics
- Product development
- Rehabilitation engineering

<http://www.design.lth.se/english>





The department of design sciences has sustainability as a main point in its strategic plan and has established a platform for cyclic thinking in design and innovation, “The Long View”. The objective for The Long View is to be the hub of the department’s ambitious work on sustainable development.

The Department has a working group that meets at least twice a year. The working group has a committee that effects the working group's plans.



## Activities

A PhD-course “Designers/engineers and Sustainable Development” (in English) open

A course for teachers at the department of Design sciences on SD

A Book study group at the department

Seminars (open)

Supporting the department board on matters concerning SD

# PhD Course partly/mainly on-demand

## Theory part (About 5 hp) Eight modules

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- M1 Introduction (with participation of Professor Will Steffen)
- M2 Sustainable Science and Technological Lock-ins (w p o Professor Lennart Olsson)
- M3 Social sustainability (w p o Assoc Professor Johanna Alkan-Olsson)
- M4 Climate change and health (w p o Professor Tord Kjellström)
- M5 LCA, economy and Supply Chain Management (w p o PhD student Katrin Molina-Besch and Professor Fredrik Nilsson)
- M6 Sustainable cities (w p o Assoc Professor Erik Johansson)
- M7 Challenges for action (w p o Assoc Professor Per Becker)
- M8 Gap filling (w p o Professor Stefan Anderberg)

# Module 1 Introduction. Goals

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After module one you should be able to:

- 1. Discuss the definition of SD and recognize its three interacting pillars
- 2. Give a “definition” of complex systems including emergence or emergent.
- 3. Describe what characterize Holocene.
- 4. Describe what characterize Anthropocene.
- 5. Explain the concept “planetary boundaries”. What is the assumption behind it?
- 6. Compare the position and trajectories between e.g. Denmark and China in the Ecological Footprint/HDI-diagram
- 7. Discuss geoengineering on a few lines (we will come back to the greenhouse effect and greenhouse gases, (GHGs)
- 8. Recognize the fundamental underlying principle to the planetary boundary approach?

# Module 1 Includes

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- 1. Introduction to sustainable development, (Sachs, 2015).
- 2. Video by professor Will Steffen. 54.23 min
- 3. Paper 1.1 The Concept of Sustainable Development and its Use for Sustainability Scenarios (Ciegis, Ramanauskiene, & Martinkus, 2009).
- 4. Paper 1.2 The Global Change to Planetary Stewardship (Steffen et al., 2011).
- 5. Paper 1.3 Planetary boundaries: Guiding human development on a changing planet (Steffen et al., 2015).
- 6. Paper 1.4 Natural capital and ecosystem services informing decisions: From promise to practice (Guerry et al., 2015).
- 7. Video 1.1 What explains the rise of humans? Yuval Noah Harari. 17.08 min
- 8. Video 1.2 The missing link to renewable energy. Donald Sadoway. 15.07 min
- 9. Video 1.3 Winning the oil endgame. Amory Lovins. 19.34 min
- 10. Video 1.4 Earth in its final century? Sir Martin Rees. 18.11 min
- 11. Paris agreements

# Module 4 Climate change and health

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- Part 4A Video introduction Climate Change Health Impact & Prevention  
By professor Tord Kjellström
- Part 4B The 2030 Agenda for Sustainable Development. Part 2
- Part 4C IPCC report 2014 Ch 11: Human health (parts)
- Part 4D Climate change threats to population health (paper)
- Part 4E Workplace heat stress (paper)
- Part 4F Climate change impacts on health via food production (paper)
- Part 4G Hans Rosling Statistic of future (Youtube)

Fully on demand



# Example on student tasks for The 2030 Agenda for Sustainable Development goals I

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“Voices around the world are demanding leadership on poverty, inequality and climate change. To turn these demands into actions, world leaders gathered on 25 September 2015 at the United Nations in New York to adopt the 2030 Agenda for Sustainable Development.” See

<http://www.undp.org/content/undp/en/home/sdgooverview.html>

This time we look at goals

- 16: Promote just, peaceful and inclusive societies and
- 17: Partnerships for the goals

# Example on student tasks for The 2030 Agenda for Sustainable Development goals II

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- 1. State the goals 16 and 17 as they are given under the photos on the page you get to from the link given above. (You may copy the goals.)
- 2. What actions are needed according to the text in order to meet each of the goals? (You may copy relevant paragraphs or meanings if it saves time – use “”.)
- 3. For each goal read one (at least) example given under the heading “Our work”. Describe the work in a few sentences.
- 4. For goal 16. What is said under facts and figures about Schools and School children?
- 5. Do you see tasks for designers/engineers? If yes, what are they? You may think especially about tasks within your area of interest (which you define yourself). Write down at least one task for each of the goals.





# Module 8 Gap filling

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- Part 8A The 2030 Agenda for Sustainable Development. Part 6.
- Part 8B Sustainability challenges for product development. Seminar by Professor Stefan Andersson. Linköping University (also on video)
- Part 8C Some biogeochemical cycles
  - The water cycle
  - The carbon cycles
  - The nitrogen, phosphorus and sulfur cycles
- Part 8D Complexity
- Part 8E Grand challenges for engineers

# Part 2 of the PhD course (about 2.5 hp)

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It includes

- a) a literature review of ongoing research in sustainability in relation to the student's own discipline and
- b) a project.

The project should include social aspects and at least some words/thoughts about economy (realism). The results could be reported as for instance a report, a seminar with a short written summary, a research proposal, visualization (poster, scale model, ..).

# Some statistics on the on-demand course, 2016-10-14

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8 PhD students attending

Part 1

4 ready with part 1; 2 have done more than 50 % of part 1

Part 2

3 have tentative plans on part 2 (see other picture)

1 more has announced that she is on track

2 will only do part 1

# Chosen subjects for literature review/project (prel)

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- The role of urban labs (urban experiments) as governance platforms to accelerate sustainable urban development. (CM)
- Sustainable Urban Flood Management. (SM)
- Write a report on how aerosol science can contribute to reaching UNs SDGs. Based on a literature review and interviews with well-known aerosol scientists. The report should be used for applying for funds for research. (VM)

# Pilot course in SD for teachers at the department I

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Important for teaching course specific sustainability in "all" courses.

The department head approved the course as one that gives pedagogic qualification. Teachers/researchers in Sweden has problem to find time for courses. Therefor it is important for them that the course gives documented qualification.

The participants of the first course are developing the form of the course when participating in it. It will have a theory part and a project part.

Questions for the pilot course to answer at: How much can the course lean on the partial on-demand PhD course? How extensive can the course be and still attract participants?



# Pilot course in SD for teachers at the department II

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The course started January 2016 together with the PhD course.

Seven participants including two members of the Long View Committee.

The teachers couldn't follow the pace of the PhD-course and they wanted a shorter course and a focus on a project.

The theory part is in a phase of development. It will probably have a flexible scope and use parts of the PhD course.

# Pilot course in SD for teachers at the department III

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The pilot course chose to develop a proposal for requirements on or recommendations for SD content in master theses at the department. The participants have read three theses each from different divisions. Their tasks were to find good examples and examples where better rules could improve the SD content.

Next picture shows an example of SD content in one of the more or less randomly selected theses.

# Content in a master thesis

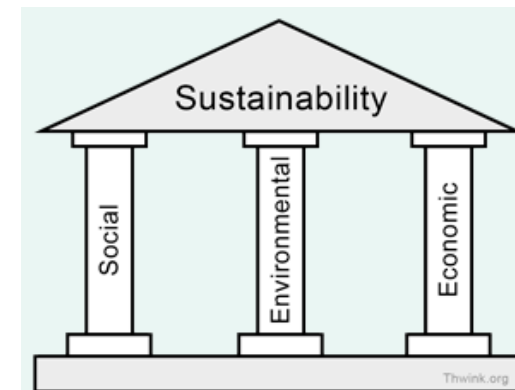
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”The goal is not only to create a sustainable material for 3D printing, but also to gain socio-economic advantages in poor areas like the favelas in Brazil. The idea is that the people living in the favelas will be able to 3D print a lot of different products out of this recycled material. For example, they can print spare parts for houses, sewage pipes or products that they can sell to get an extra income just to mention a few possible applications of the material.”

From: Creating a new material for 3D printing out of recycled materials  
Master thesis in Product development, Dept of Design Sciences, Faculty of engineering, Lund University  
By Charlotta Engstrand

Rubber from old tires + collected used plastics

This is a good example on what we want: Engineers considering





# Pilot course in SD for teachers at the department IV

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Here we see that the master student in engineering has reflected on the social, environmental and economic pillars of sustainable development. We want all our students to make such reflections, but of course all topics for master theses do not offer so good possibilities to put in SD content and reflections.

# Pilot course in SD for teachers at the department V

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Now the teacher group are developing questions the master students should ask themselves about their thesis. The questions will be based on, e.g., UN sustainable development goals and the "Brundtland definition". The group also found the following list of examples on factors important for SD.

But the group is not ready yet with their suggestion on how to get all students to reflect on relations between their master thesis and SD.

The group will also give suggestions on forms for coming SD-courses for teachers.

# Examples of factors contributing to sustainable development

## Minna Gillberg 2001

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### Social

- Gender equality
- Democracy/opportunity to influence the development of society
- Access to free information
- Health and quality of life
- Housing
- Education
- Power and influence over one's own life situation
- Opportunity to practise one's culture
- Freedom of religion and speech

### Economic

- Distribution of resources between countries and people
- Opportunities for work and livelihood
- International development cooperation/aid
- International trade which promotes sustainable development
- Sustainable patterns of production and consumptions
- Consumer influence
- The importance and responsibility of industry
- Technological development

### Ecological

- Limit the emission of residues into air, land and water to levels which nature and people can tolerate
- Preserve biological diversity
- Save finite resources
- Preserve the production capacity and resistance of ecosystems and other life-supporting systems
- Protect and preserve aesthetic and cultural values associated with nature

# The Long View Book Club

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Book 1: Naomi Klein, This change everything: Capitalism vs. The Climate  
Swedish or English version.

Announced in April 2016.

34 signed up. Staff and faculty.

The books were paid by the department and handed out in May.

We had a 2-hour discussion around the book September 28. Only 12 took part in this first discussion opportunity. Few had read all the book (655 pages in the Swedish version).

Good discussion. Some comments: An eye-opener. Many interesting examples. Too many words – the message could be clear in a much thinner book. It's a pity the book is so one-eyed politically.

# My coordinates

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# The following experts have contributed considerably to the PhD course. Thanks!

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- Professor Will Steffen, lecture and video
- Professor Lennart Olsson, lecture
- Assoc professor Johanna Alkan-Olsson, video introduction
- Professor Tord Kjellström, video introduction
- PhD student Katrin Molina-Besch, workshop
- Professor Fredrik Nilsson, video
- Assoc professor Erik Johansson, video introduction
- Associate professor Per Becker, seminar
- Professor Stefan Anderberg, lecture and video

Administration and some teaching: Roland Akselsson, Olof Kolte and Karin Lundgren-Kownacki