Doctoral studies and sustainable development

Personal experiences from KTH

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Important personal activities carried out in the PhD education at KTH for Sustainable Development 1990-2013

- **Presentation of the PhD course Frontiers and Strategies in Environmental Science in cooperation with Per Jacobson**

- **KTH Research School for Environmental Management, initiated with support from Ångpanneföreningen's Foundation for Research & Development (1998-2002)**

- **The Research School was renamed to KTH Research Forum for Sustainable Development in 2002 with extended financing from Ångpanneföreningen's Foundation for Research & Development (2002-2007)**

- **Other PhD courses presented in the years 2007 - 2013**

PhD courses developed and presented as part of the KTH Research Forum for Sustainable Development 1998-2008

1. *Energy Systems and Models, Per Lundquist, 5 credits ECTS)*
2. *Environmental Management – Organisational aspects of the work for sustainable development (Staffan Laestadius, 5 credits ECTS)*
3. *Environmental Science, Vladimir Cvetkovic and Per Jacobson, 5 credits ECTS)*
4. *Environmental Innovation (Ernst Hollander, 5 credits ECTS)*
5. *Environmental Chemistry with Emphasis on Atmosphere-, Water- and Soil Chemical Processes (Olle Wahlberg, 5 credits ECTS)*
6. *Case Study Methodology (Rolf Johansson, 5 credits ECTS)*
7. *Environment as a Competitive Edge (Reine Karlsson Hans Lundberg, 5 credits ECTS)*
8. *Environmental Systems Analysis, (Björn Frostell, 5 credits ECTS*
9. *Environmental Strategies Methods (Mattias Höijer, 5 credits ECTS)*
10. *Actors, strategies and institutions for Sustainable Development (Hans Lundberg, 5 credits ECTS)*
11. *Sustainable Development in a Global Perspective - Constraints and Possibilities with Emphasis on Energy and Water (Björn Frostell, 5 credits ECTS)*
12. *Integrated water resources management (Bengt Hultman, 5 credits ECTS)*
13. *Sustainability Science (Björn Frostell and Per Jacobson, 5 credits ECTS)*
14. *Energy, Systems and Sustainability (Per Lundquist, Örjan Svane and Björn Frostell, 5 credits ECTS)*

PhD courses developed and presented by Björn Frostell and co-workers during later years

Sustainability Science (Björn Frostell and Per Jacobson, 5 credits ECTS – 2007, 2011, 2013)

Sustainability Challenges for the Nordic Forest Industry (Björn Frostell, Per Lundquist and Staffan Laestadius, 5 credits ECTS - 2009)

Systems Thinking for Innovation in a Complex World (Björn Frostell + students, 12 credits ECTS – 2012)

Experiences and lessons learnt

From the years with the KTH Research Forum for Sustainable Development, there is a substantial amount of (i) course development efforts and material and (ii) course implementation experience available that still could support the further development of KTH PhD education for sustainable development.

Education and research for Sustainable Development in a PhD context requires a means of holistic thinking that rarely was present in PhD students during these years. This holds especially true for PhD students coming from traditional engineering sciences. Typically there was a lack of ability ”to think out-of-the-box”.

PhD students carrying out individual paper preparation exercises in SD oriented courses required much help in (i) ordinary paper preparation support (e.g. scientific writing, organisation of a scientific paper, critical thinking) and (ii) a lack of holistic thinking as mentioned above (shining exemptions to this general conclusion could normally be found).

Three areas that should be further fostered in PhD education for sustainable development are (i) courses devoted to systems thinking (~life cycle thinking in sustainability dimensions) (ii) increased cooperation between engineering disciplines and other disciplines and (iii) development of models and computer based methods for forecasting and assessment of future options to development with focus on avoiding uninteded consequences of improvement actions in complex systems.