



**KTH Architecture and
the Built Environment**

Annual report

Division of Environmental Strategies Research - fms

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Introduction

The year 2006 was the third year for fms at KTH. It was as exciting as the previous two. Let us highlight some of the most interesting developments:

- Rebecka Engström and Daniel Jonsson successfully defended their PhD theses and Åsa Moberg her Licentiate thesis. These were also the first theses in the new research subject orientation: Environmental Strategic Analysis within the research subject Infrastructure.
- Anna Björklund and Mattias Höjer became Associate Professors in Environmental Strategic Analysis.
- Vinnova granted funding for The Excellence Centre for Sustainable Communication at KTH. The Centre is a cooperation between the Department of Media Technology at the School of Computer Science and Communication at KTH, us at fms, and ten external partners.
- Fms has continued to grow. Several researchers including the Associate Professors Maurtiz Glaumann (part time) and Örjan Svane (full time) and Fil Lic Tove Malmqvist joined the group and added their significant experience and knowledge.

Environmental Strategies Research – fms

What can a sustainable society be like?

What can we do today to approach a sustainable development?

How can we measure environmental impacts of products, services and other systems?

These are questions that fms work with. The Division of Environmental Strategies Research – fms is a part of the Department of Urban Planning and Environment, which in turn is a part of the School of Architecture and Built Environment. Fms' aim is to develop solutions for, knowledge on and debate around strategic environmental problems. This is primarily done through multi-disciplinary research. The area of research is the interconnections between environmental issues, technological developments and societal change. With strategic environmental problems we mean environmental problems that are important and require long-term solutions. The problems may be globally important or important for Sweden, a sector, a company or an agency. Today fms is primarily active in three areas: Future studies, tools for environmental assessment and management and processes of change.

Within the area of future studies we base our work on systems analysis and use different types of scenario techniques such as backcasting and external scenarios. The concept of Sustainable development is important and often used as a starting point. The concept of sustainable development includes three dimensions: Ecological, Social and Economic Sustainability. We often operationalise the concept and define it in terms of ecological sustainability where economic and social impacts are assessed in integrated studies.

Within the area of tools for environmental assessment and management we develop and use different environmental systems analytical tools such as life cycle assessment, strategic environmental assessment and life cycle costing. We also study how these different tools can be used for management at different levels.

Within the area of processes of change we study behavior, lifestyles, policy instrument and strategies. In order to accomplish long-term solutions we need better knowledge in these areas. Policy instruments and strategies are bridges between the current situation and the future scenarios. In order to reach a sustainable development we need instruments, and the effect of these can be studied with different environmental systems analysis tools. It is of importance to find solutions in the short term which also are suitable in long-term solutions.

The tools that we are using are employed in a number of areas such as infrastructure, buildings, information technologies, transportation, consumption, solid waste management and defense applications.

History

The Environmental Strategies Research Group (in Swedish “Forskningsgruppen för miljöstrategiska studier” (fms)) was formed in 1993. It was created as cooperation between the Swedish Defence Research Agency (FOI) and the Department of Systems Ecology at the

Stockholm University. Fms was started by the late Peter Steen who was a Research Director at FOI and an Adjunct Professor at Stockholm University. The idea behind the cooperation was to apply tools and methods from the area of systems analysis that were used at FOI, to the area of sustainable development. The group represented something new and interesting in environmental research and attracted external funding from a number of different sources and grew to approximately 20 persons when Karl-Henrik Dreborg became the head of fms in 2000. At this time the group consisted of researcher also from several departments at KTH and the Stockholm Environment Institute. In 2003 KTH started the Centre for Environmental Strategies Research providing an organizational platform for the group. In 2005 the Centre was reorganized to a Division making the group a more “normal” unit at KTH being involved in both research and education. This has been manifested during last year in the creation of the subject orientation Environmental Strategic Analysis. Today fms consist of researchers employed at KTH and associated researcher employed at other institutes.

Economy

For the third year in a row, fms continued to grow and gave an economic surplus. The total incomes during 2006 were 8.6 Mkr (compared to 6.5 Mkr during 2005) and the economic surplus was 20 kkr (compared to 100 kkr during 2005). The incomes were external research funding: 6.9 Mkr, internal research funding from KTH: 1.4 Mkr, and funding for basic education: 0.3 Mkr. For 2007 we have a budget for 8.6 Mkr and a balanced result.

User's council

During 2006 we started a user's council that can act as a reference group to fms. It met twice during 2006 and consisted of the following persons:

Lars Berggrund, Swedish Rail Administration
Mona Blomdin Persson, Swedish National Chemicals Inspectorate
Göran Cars, KTH
Tommy Hoff, Locum
Sven Hunhammar, Swedish Environmental Protection Agency
Björn Hårsman, KTH
Catherine Karagianni, Teliasonera
Christina Lindbäck, Ragnsells
Kajsa Palo. Stockholms stad
Johan Rockström, Stockholm Environment Institute
Conny Rolén, Formas, the Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning
Anna Sander, Ministry of Environment
Christine Wallgren, Vinnova (Swedish Governmental Agency for Innovation Systems)
Paul Westin, Swedish Energy Agency
Helene Wintzell, Helene Wintzell AB

Personnel during 2006 and early 2007



Göran Finnveden

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Head of the Division of Environmental Strategies Research – fms, and vice head of the Department of Urban Planning and Environment. He is an Associate Professor in Industrial Ecology, a PhD in Natural Resources Management from Stockholm University and a MSc in Chemical Engineering at KTH. He has published over 45 scientific papers on diverse issues such as the development and use of environmental systems analysis tools such as life cycle assessment, Waste management, Environmental Policy Integration, Integrated Product Policy and Waste policy.



Sofia Ahlroth

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Sofia Ahlroth, senior economist. Currently working in the “Governmental Commission on Climate Change and Vulnerability” but will return to fms, in October. Previously she has worked at the Ministry of Environment, National Institute of Economic Research, Statistics Sweden, and the Swedish EPA from which she is currently on a leave.



Karin Alverbro

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M. Sc. Chemistry



Anna Björklund

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Associate Professor Environmental Strategies Research, PhD in Industrial Ecology. Research leader at fms. Anna’s main research focus is environmental systems analysis and life cycle assessment (LCA) of waste management, with applications to local planning and strategic environmental assessment (SEA). Other areas of research have been LCA as a tool in SEA of municipal energy planning and the integrated use of environmentally extended input-output analysis and LCA in the field of integrated product policy (IPP). Anna also teaches a course in LCA and is a supervisor of Master thesis projects.



Karl-Henrik Dreborg

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Karl-Henrik is a Research Leader at FOI (Swedish Defence Research Agency) but works part time also at fms. He is an expert in scenario techniques and got his PhD in Regional Planning at KTH.



Rebecka Engström

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Rebecka finished her PhD in 2006 and is now working at the Swedish Energy Agency.



Mauritz Glaumann

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Associate professor. Research interest: Environmental impact of buildings. Assessment methods and tools. Sustainable building design.

Mauritz Glaumann has been responsible for developing the EcoEffect tool for environmental assessment of buildings (www.ecoeffect.se). It comprises internal impact, i.e. impacts which affect users of the building and the site, and external impact that affect people elsewhere and maybe in an other time due to use of the building, i.e. heating, ventilating, emissions etc. These two different kinds of impacts shown in a diagram displays the ecoefficiency of a building. The needed aggregation of impact categories has been developed based on the DALY (Disability Adjusted Life Years) concept. Calculation of external impact is based on LCA and internal impacts is based on criteria for comfort and health. Research projects: Environmental classification of buildings (Formas, Energimyndigheten) and Environmental management of the building design process (Formas). Mauritz works mainly at the University of Gävle but also part time at fms.



Ulrika Gunnarsson

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MSc Spatial planning. PhD student at fms. The PhD project handles long term planning from an environmental justice as well as a gender perspective. Responsible for the course Futures studies and forecasts together with Mattias Höjer.



Leif Hedberg

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Economist. Research Director. Futures studies of an environmentally sustainable defence sector, transport policy and sustainable mobility, buildings and energy systems in sustainable society. Leif has recently retired from FOI but continues at part time at fms.



Greger Henriksson

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Master of Arts and PhD student, European Ethnology at Lund University. Research on habits and cultural patterns related to travel and consumption. At present working with congestion charges in Stockholm, examining how the trial period has been experienced and handled by a number of inhabitants in the region.



Elisabeth Hochschorner

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PhD student working on including life-cycle thinking in green public procurement with a special focus on the defence sector.



Mattias Höjer

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Associate professor.



Jessica Johansson

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M.Sc in Biology-Earth Science. Part time employee at fms, also working for the Swedish Defence Research Agency (FOI), and PhD-student in Spatial planning at Blekinge Institute of Technology. The topic of the thesis work in how scenario methods can be used in societal planning and strategic environmental assessment. Currently engaged in a project at fms where scenarios of a future sustainable Swedish energy system are developed.



Daniel Jonsson

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Daniel K. Jonsson

PhD in Environmental Strategic Analysis, MSc in Engineering Physics. Researcher at FOI (Swedish Defence Research Institute) but also working part time at fms with projects on transport and infrasystems.



Tove Malmqvist

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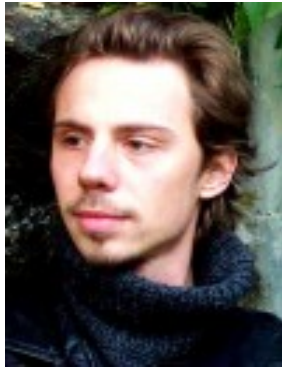
M Sc Environmental Science, fil. lic in Infrastructure - Built Environment Analysis 2004. Ph D student. Developing methods for environmental assessment of buildings, in particular for existing buildings. At the moment participating in the fms-project Environmental Classification of Buildings, mainly with focus on indoor environmental issues.



Åsa Moberg

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Phil lic Infrastructure, Environmental strategies research. Part time working at fms and part time at STFI-Packforsk. Main working areas are life cycle assessment, indicators and other tools for environmental and sustainability assessments.



Ilari Ohring

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Master degree in environmental science. Administration and Research engineer.



Liselotte Roth

PhD. During 2006 and early 2007 she worked on a number of topics related to waste management, scenario planning and defence issues. She has now left fms and started to work at RGS90.



Örjan Svane

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(Associate Professor, Architect SAR, b -46) has long experience as a practising architect, doing project design and implementation as well as resident consultation, mainly applied to the refurbishment of housing. He also practised within the field of sustainable construction. These themes he now combines in his research, with the overarching theme "Environmental Management of the Built Environment". His thesis work was based on an interview study of the environmental practice of twelve successful Swedish housing companies. The thesis, "A Sustainable Neighbourhood", has a focus on the environmental practice in the small neighbourhood. Thereafter, he has participated in research also on households, housing and sustainability and on experimental eco-building. In the last few years, the main focus has been on the theme of urban sustainable development.



Åsa Svenfelt

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Systems-ecologist, ph.lic in Natural Resources management 2000. Research interest: exploring the interface between society and ecological systems, viewing the former as an integral part of the latter. Earlier projects were focused on exploring the importance of local ecosystem dependency on local to regional scales. Later projects have been more focused on providing structures and systems for enabling sustainable use and management of resources and ecological systems. Methods used have been environmental systems analysis, interview-studies in production/consumption systems and future studies. All projects have involved either stakeholder interviews or stakeholder collaboration. The focus areas have been mainly the food sector, the building sector and the national environmental quality objectives.



Sara Tyskeng

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PhD in Environmental Systems Analysis and Environmental Management from Linköping University (2006). She started her employment at fms in April 2007. She currently participates in three different research projects. One project concerns the development of scenarios to be used when developing the Swedish waste management system, another concerns the use of tools in Ex-post SEA (Strategic Environmental Assessment). The third regards how life-cycle perspectives can be used in the procurement process in the Swedish defence.



Jonas Åkerman

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Research leader. His key research area is interdisciplinary future studies focusing on sustainable mobility. Since 2000 he has been in charge of the transport future studies programme at fms. This programme has consisted of research tasks in the following areas: sustainable air transport, a sustainable transport system for Greater Stockholm and decoupling of transport growth from economic growth. At present he is leading a future study concerning the feasibility of major greenhouse gas reductions (-80%) in the Swedish energy- and transport system until 2050.

Associated researchers



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Architect SAR/MSA, Ph D student. I am a PhD student since October 2006. My field of study is environmental management used in planning and design of architecture for a more environmentally sustainable society. Among other things it includes how to utilize environmental strategies and environmental assessment methods.

Parallel to my studies I am working as a practicing architect. This combination of research and architectural practice nurture my interest in designing environmentally sustainable architecture by combining research with practice.



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MPhil in Infrastructure and PhD candidate at fms.

Her PhD studies are carried out as part of her current work as Research Fellow in the University of Birmingham, where she is involved on a large multidisciplinary research project examining the role and relations of sustainability in the urban regeneration process of Birmingham's Eastside district. Other research interests include: Urban Studies, Planning, Public Transport & Sustainable Development.

Projects – examples of finished and ongoing projects

Projects finished during 2006

Consequences of Policy measures

A short-term project ended in February 2006 on suburban families that travel extensively. Their sensitivity for travel related policy measures was investigated through interviews. Included in Henrikssons Ph D-project and coordinated with the Stockholm Trial project (below).

Funding: Swedish EPA

Period: 2005-2006

Contact person: Greger Henriksson

Valuation of ecosystem effects of exhausts from road traffic

To extrapolate values from valuation studies for a specific area to other regions and to the national level, a benefit transfer method called preference calibration is tested for eutrophication. Valuation functions for eutrophication of sea and freshwater in Sweden are estimated, and point estimates for nitrate in drinking water and acidification are calculated. The values are allocated to the causing pollutants, including nitrogen, nitrogen oxides, nitrate, phosphorus, ammonia and sulphur dioxide. Total damage values for acidification and eutrophication per kg of the selected pollutants are calculated. Damage values per km of different vehicle types are also presented. The results are added to existing values for health from the EU project ExternE and compared with existing regional damage values.

Funding: Swedish Road Administration

Period: 2005-2006

Contact person: Sofia Ahlroth

Scenarios and the Environmental Quality Objective 'A good built environment'

In this project, a workshop using explorative external scenarios to evaluate the national environmental quality objective "a good built environment", was organised for Boverket. The workshop was held in Karlskrona in June 2006.

Project leader: Rebecka Engström

Other project members: Åsa Svenfelt

Financier: Boverket

Project period: 2006

Policy integration for sustainability

Policy integration for sustainability (PINTS) is a four-year research project focused on the energy and agricultural sectors in Sweden and in the EU. The project seeks to contribute to a policy system that better integrates environmental concerns into its processes and structures. The project is funded by FORMAS. It is a collaboration between the Stockholm Environment Institute, the Department of Political Science at Umeå University and fms (the Environmental Strategies Research Group) at KTH. Currently fms is involved in an environmental assessment of the energy and agricultural sectors.

Period: 2002-10-01 - 2006-10-01

Personell: Göran Finnveden and Rebecka Engström

Keywords:

Environmental assessment, Life cycle assessment (LCA), Energy, Agricultural wastes, Environmental policy, Political science

Projects continuing 2007

Development of tools for strategic environmental assessment and public participation

Development of local energy systems, i.e. supply, distribution and use of energy in a municipality, is crucial for overall environmental performance of national energy systems. It follows that availability and effectiveness of instruments to control this development are of great interest. For local authorities, energy planning may be such an instrument. Swedish legislation mandates each local authority to issue a plan for all supply and use of energy. In accordance with the EU directive 2001/42/EC, legislation now also requires that such plans include environmental assessment. This is often referred to as strategic environmental assessment (SEA). The goal of this project was to implement and evaluate tools for SEA in municipal energy planning. The hypothesis was that such tools will improve the planning process, compared with current practice, and subsequently the energy plan in terms of its ability to direct the development of local energy systems towards less environmental impact. This development includes both increased energy efficiency and use of renewable energy sources. A planning process based on earlier studies of energy planning, on the EU-directive, and on earlier SEA processes was proposed and implemented in a Swedish municipality. Several tools were included, such as, scenario analysis, environmental life cycle analysis, and public participation in the form of citizen panels. The

planning process was completed in 2006. During spring 2007, the project process and results are being evaluated.

Project leader: Anders Mårtensson, Linköping University.

Other project members: Hans Wiklund and Per Viklund, Statsvetenskapliga institutionen, Jönköping International Business School; Anna Björklund, fms; Jenny Stenlund Nilsson, Linköping University.

Financier: This project was a part of the research program MiSt, which is financed by the Swedish Environmental Protection Agency.

Project period: 2003 - 2007

Contact: Anna Björklund

Life cycle management in the acquisition process

In order to further emphasize environmental concern in the acquisition process life cycle aspects are addressed, as these would raise the level of ambition. This is because life cycle thinking puts the focus on products and materiel in general and its environmental interventions throughout the entire life cycle. The summary report delivered from this project discusses how to integrate appropriate tools, such as Life Cycle Assessments (LCA) and Life Cycle Costing (LCC), for environmental assessment of purchasing into the acquisition process of defence materiel. This project is also a PhD project for Elisabeth Hochschorner.

Project leader: Joakim Hägvall, FOI.

Partners: Anna Björklund, KTH, Göran Finnveden, KTH, Elisabeth Hochschorner, KTH, Liselott Roth, KTH and Rolf Tryman, FOI.

Funding: Swedish Defence

Period: 2004-2007

Contact persons: Göran Finnveden och Elisabeth Hochschorner

The Stockholm Trial – travel habits in a flash

A documentation project concerning the Stockholm Trial started in January 2006 when the congestion charges were implemented. The documentation finished in the end of 2006. Greger Henriksson and staff of the Stockholm City Museum carried out interviews with citizens, took photographs and collected travel diaries, objects and press material. Based on this an analytical project was launched in September. The issue concerns how the trial was experienced and handled in the everyday life of Stockholm county residents. It will continue during the first half

of 2007 and results will be published by in an illustrated book in two editions, one in English and one in Swedish. The study is also included in Henrikssons Ph D-project.

Funding: The City of Stockholm and the County of Stockholm

Period: 2006-2007

Contact person: Greger Henriksson

Potential for increased source separation and recycling of household waste

Increased source separation and recycling of household waste is important in order to use the resource potential in household waste and also in order to reach higher levels in the waste hierarchy. This ambition is also emphasised in the Swedish environmental objective addressing “A good built environment”. Therefore, it is interesting to discuss if and how to expand the producer responsibility for packaging waste to enclose also consumer products from household waste.

This project is a pilot study to a larger project addressing hindrances and possibilities for an expansion of the producer responsibility for packaging waste. The project’s aims are to i) identify the amount of materials, especially metals, plastics, glass and paper and cardboard, that is available for recycling, ii) to research practical prerequisites for collecting and treatment of the potential fractions of source separated household waste, and iii) to estimate differences in global warming potential between the present treatment of household waste and another system enclosing full recycling of available amounts of metals and plastics in household waste.

Funding: Swedish EPA

Period: 2006-2007

Contact persons: Liselott Roth and Göran Finnveden

Screening LCA of printed newspaper, web based newspaper and tablet e-paper newspaper

Daily news is something most of us are related to. Nowadays we can get news through different forums, e.g. news on TV; news on the radio; printed newspapers; web based newspapers and a recent addition to this list is the tablet e-paper newspaper. Electronic paper (e-paper) is an electronic display device that aims to be paper-like. In addition the e-paper alternative requires less energy in the use phase than reading news on the web. The tablet e-paper will reduce the use of paper and also the use of energy for reading the news compared to the printed newspaper and the web based newspaper respectively. But what about other parts of the e-paper life cycle; the production of the e-paper device; the waste management of old devices; use of infrastructure for electronic distribution? What will be the environmental impacts of these activities?

The aim of this project is to describe the potential environmental impacts of three studied product systems; printed newspaper, web based newspaper and tablet e-paper newspaper. A screening LCA is performed, aiming to draw rough conclusions on the potential impacts of the three studied newspaper systems. The results will illuminate which activities, part of the respective product system, that are most important from an environmental point of view. The results will also provide the opportunity to compare the potential environmental impact of the three studied products systems, given the assumptions made. Another aim of the study is to identify data gaps and areas where more information is needed.

The project is a forerunner within the Centre for Sustainable Communications and it is performed in co-operation with STFI-Packforsk.

Project leaders: Alex Jonsson, Centre for Sustainable Communications, KTH and Åsa Moberg

Other participants: Göran Finnveden fms, KTH, Martin Johansson STFI-Packforsk and Åsa Moberg fms, KTH.

Partners: STFI-Packforsk

Financing: TU and STFI-Packforsk

Time period: 2006-2007

Contact person: Åsa Moberg

Strategic decisions based on environment and safety

Many decision-making situations today affect both risk and environment. In practice many of these decisions are made without an overall view and decisions are made within one of these frames. Now and then these two areas of regulations are at conflict, i.e. the best alternative according to environmental considerations is not always the most safe way and vice versa.

The aim of this project is to construct a tool where the issues of environmental and safety concerns are integrated and decisions can be made with regards both to environmental and safety concerns. We will study a case with regards to environmental and safety. Such a relevant issue is the decision of disposal of explosives. This is an example where the environmental aspects may be in conflict with the regulation of (personel) safety, for exemple in case of open burning or detonation.

Project leader: Göran Finnveden fms, KTH

Other project members: Anna Björklund and Karin Alverbros fms, KTH, Joakim Hägvall, FOI.

Funding: Swedish Rescue Services Agency

Time period: 2007-2009

Contact person: Karin Alverbro och Göran Finnveden

Strategies for non-toxic and resource efficient eco-cycles in different future scenarios

Every fourth year, the Swedish National Environmental Objectives are subject to a major evaluation regarding e.g. progress, fulfillment of goals, and proposals for new sub-objectives. The next evaluation report will be presented to the government in 2008. This time, the sixteen objectives are also dealt with in three strategies, in order to manage objectives that are closely related in the sense that there may be synergies, or conflicts for that matter, between measures to fulfill these goals. One strategy is the "Strategy for non-toxic and resource-efficient eco-cycles" (In Swedish: Giftfria och resurssnåla kretslopp, GRK).

Our project contributes to the evaluation of the GRK-strategy. Its objective is to present packages of measures and policy instruments for the GRK-strategy, and to evaluate these under various possible future developments, using so-called explorative external scenarios. In this work, we build on the results from the project "Scenario methodology and environmental objectives" (project leader Mattias Höjer). The project also handles objectives that are difficult to achieve, using backcasting techniques with normative future scenarios.

An ambition in this project is to illustrate to stakeholders involved in this complex process of evaluation of the environmental objectives and strategies, how scenario techniques can be applied to address some important issues. An important role of this project is also to act as a catalyst in the environmental objectives' evaluation process, by forcing participants to contribute at an early phase in their own work.

Project leader: Anna Björklund

Other project members: Åsa Svenfelt, Liselott Roth, Mattias Höjer, Karl-Henrik Dreborg

Financier: Swedish Environmental Protection Agency

Project period: 2006-2007

Strategies for management of land, water and the built environment in different future scenarios

This project has the same objectives and uses similar methods as the GRK-project described above, but concerns the strategy for management of land, water and the built environment (Hushållning med mark, vatten och bebyggd miljö – HUM).

Project leader: Åsa Svenfelt and Rebecka Engström

Other project members: Mattias Höjer

Financier: Swedish Environmental Protection Agency

Project period: 2006-2007

Scenario Methods and the Swedish Environmental Objectives

Finding ways of handling conflicting goals with scenario methods.

Researchers: Anna Björklund, Karl-Henrik Dreborg, Rebecka Engström, Ulrika Gunnarsson, Mattias Höjer, Liselott Roth, Åsa Svenfelt and Jonas Åkerman.

Financed by: the Swedish Environmental Protection Agency

Time period: 2005-2007

Contact person: Mattias Höjer

New Suburban Nodes for a Sustainable Future

The general aim of this project is to analyse what implications urban form have for sustainable development and environmental justice. The dominance of city cores in many European cities are to an increasing degree being challenged by new exploitations on cheaper land with good car-accessibility around the cities. As cities continue to grow, such exploitations can become either an integrated part of the cities or they may continue to cultivate their competitive advantage of being easily accessed by private car. Depending on how those areas are developed, the consequences for ecologically sustainable development and environmental justice will vary, and different measures will be needed to safeguard their positive change.

Project leader: Mattias Höjer

Researchers: Ulrika Gunnarsson and Mattias Höjer

Financed by: Formas

Time period: 2006-2007

Contact person: Mattias Höjer

Environmental assessment of waste management

This project is part of the research program "Tools for Sustainable Waste Management", financed by the Swedish Environmental Protection Agency. The aim of the project is to contribute to sustainable waste management by assessing the effectiveness of waste policy instruments with regard to life-cycle environmental impacts. Such policy instrument will be proposed by another project within this research program. Waste and environmental process data of the Swedish waste management system will be compiled in a generally accessible data package, and further

implemented in a generic LCA-tool, which will be used to assess life cycle environmental impacts of policy instruments. Substance flow analysis (SFA) will be used as a complement for more detailed analyses of the risk of increased and/or uncontrolled flows of hazardous substances.

Project leader: Anna Björklund

Financier: Swedish Environmental Protection Agency

Project period: 2006-2011

Tools for Sustainable Waste Management – Synthesis

This project is the synthesis project of the research programme “Tools for Sustainable Waste Management” which consists of approximately 10 different projects and approximately 10 different partners. The research programme is financed by the Swedish Environmental Protection Agency and is led by Tomas Ekvall at IVL. Fms is responsible for the synthesis project which has already started. In this early stage of the programme, the synthesis project will develop external scenarios that can be used in the other projects to assess environmental, economic and social impacts of different policy instruments within the waste sector.

Project leader: Göran Finnveden

Project period: 2006-2011

Sustainable energy- and transport systems – A pilot study using backcasting

This synthesis study contains three parts. The first part is a review of the state-of-the-art regarding futures studies on energy and transport. Scientific reports are complemented by interviews with key persons in science, in industry and in politics. The second part of the study consists of a pilot study using a backcasting approach. Based on the review and fms experience in the field, 2-4 images of a future energy- and transport system will be outlined. These should reach an 80% reduction of greenhouse gas emissions and also comply with the environmental objectives relating to air pollution. The system delimitation is Sweden’s energy- and transport system in a global context. Key issues analysed are the future supply of carbon neutral primary energy and the potential for energy efficiency improvements in industry, housing and transport. Next policy measures and possible paths towards the images are analysed. Of special interest are the time lags in the human and the technical-economical systems, and the stakeholders involved. The project team has solid experience in natural sciences, economics and political science. The latter are important in order to analyse paths which are cost-effective and acceptable to citizens and stakeholders. In the third part a framework for an upcoming research call is outlined.

Project team: Jonas Åkerman, Karolina Isaksson, Jessica Johansson and Leif Hedberg

Funding: Swedish Environmental Protection Agency

Time period: 2006 – 2007

Contact: Jonas Åkerman

Sustainable transport in Stockholm 2050

In this backcasting study the possibilities to reach a sustainable transport system in greater Stockholm are explored. Four images of the future 2050 are outlined, all reaching a 80% reduction of greenhouse gas emissions and a substantial reduction of energy use. The focus in the images is on functional accessibility rather than mobility. The four images show different futures regarding for instance urban structure, the role of IT and the role of the car.

Part of the study concerns how to turn the present development into a sustainable direction as illustrated by the images of the future. Policy packages should be effective, acceptable and robust in the context of different global scenarios.

Project team: Jonas Åkerman, Greger Henriksson, Mattias Höjer, Daniel Jonsson, Måns Nilsson, Åsa Swartling and Oskar Wallgren

Funding: Vinnova and the Swedish Energy Agency

Time period: To be finished in 2007

Contact: Jonas Åkerman

Common techniques for environmental systems analysis tool

The main objective is to enhance the efficiency, applicability and integration of environmental systems analysis tools in decision-making by developing streamlined common techniques and components that can be used in several tools. Examples of tools to be included are Strategic Environmental Assessment, Environmental Management Systems with Environmental Auditing, Life Cycle Assessment, System of Economic and Environmental Accounts and Cost-Benefit Analysis. Examples of common techniques include scenario techniques, dynamic modelling, valuation methods and site-dependent impact assessment. Developed techniques and guidelines will be tested in case studies, mainly chosen from the energy sector.

Period: 2002-05-01 - 2007-12-31

Keywords:

Economics, Environmental assessment, Life cycle assessment (LCA), Life cycle costs, Environmental weighting, Strategic environmental assessment (SEA), Cost-benefit, Environmental management system, Environmental accounting

Funding: Mistra (The Foundation for Strategic Environmental research)

Personnel: Göran Finnveden, Sofia Ahlroth, Mattias Höjer and others.

Indicators for IPP

Integrated Product Policy (IPP) is a policy area aiming at reducing the environmental burden of products and services throughout their life cycle by using a toolbox of policy instruments aimed at green markets through both the demand side (consumption) and the supply side (product development). Indicators for IPP are needed to measure the environmental improvements induced by the IPP approach. The project is run in cooperation with Statistics Sweden. The project is a part of the research programme FLIPP funded by the Swedish Environmental Protection Agency.

Period: 2004-01-01 - 2007-12-31

Keywords:

Policy instruments, Life cycle assessment (LCA), Environmental policy

Personnel: Göran Finnveden, Anna Bjröklund, Åsa Svenfelt at KTH and Viveka Palm, Annica Carlsson and Anders Wadeskog at SCB.

Environmental classification of buildings

The project aims to develop a system for environmental classification of buildings. The system should be based on a life-cycle perspective. It will take into account both national and international scientific development as well as stakeholder needs. In the initial phase, an overview of existing methods for environmental classification/evaluation of buildings and the need for methodological development will be made. This will be the basis for the development of a preliminary proposal. Methodological issues, which may need consideration, include crediting for recycling of materials, assessment of chemicals, assessment of natural resources, weighting and valuation of environmental impacts and data quality issues. The system will be developed and also tested in cooperation with stakeholders. Based on experiences from the testing and evaluation, a final suggestion will be developed.

Period: 2005-01-01 - 2007-12-31

Keywords:

User oriented, Building, Cooperation, Life cycle assessment (LCA), Environmental impact, Classification

Funding: Formas, the Swedish Energy Agency and A number of organisations and enterprises

Personnel: Göran Finnveden, Mauritz Glaumann, Tove Malmqvist, Åsa Svenfelt, Helene Wintzell and Ola Eriksson

Sustainable images of the future - for women and men? (FramKoM)

FramKoM is a cooperation between KTH and Linköping University. The overall aim of the project is to contribute to and deepen the knowledge concerning gender-aware planning for sustainable development. More specifically, the objective is to give new empirical and theoretical knowledge on how so-called sustainable images of the future, used in future studies, affect

women and men and to discuss whether or how these images could be transformed to become gender equal.

Common features in futures studies are time use, regional enlargement and activity patterns related to transportation systems. All features have different effects on the environment, but also on women and men's everyday life. These are therefore the dimensions that will be examined from a gender perspective in the project.

In the synthesising part of the project, sustainable images of the future are reformulated to become gender equal. However, there are many difficulties with measuring gender equality already today. To measure gender equality in future societies is even harder. This is why the synthesising part of the project might instead of gender equal images of the future be a discussion of why these images are so hard to construct. This may also give the foundation for a discussion on the risks of planning gender neutrally.

Period: 2006-09-01 - 2009-12-31

Keywords:

Environmental aspects, Future studies, Gender perspective, Sustainability

Project leader: Mattias Höjer

Funding: Vinnova

Personnel: Mattias Höjer, Ulrika Gunnarsson and Tora Friberg (Linköping University)

Contact person: Mattias Höjer

PhD and Licentiate theses

Åsa Moberg, Licentiate thesis: *Environmental systems analysis tools for decision-making - LCA and Swedish waste management as an example*. Licentiate Thesis, TRITA-SOM 06:002, KTH, Stockholm.

Rebecka Engström, Doctoral Thesis: *Food, energy and the environment from a Swedish perspective*. Doctoral Thesis, TRITA-SOM 06-009, KTH, Stockholm.

Daniel K. Jonsson, Doctoral thesis: *Situations of Opportunity for Infrasystems, Understanding and pursuing change towards environmental sustainability*. Doctoral Thesis, TRITA-SOM 06-10, KTH, Stockholm.

Courses

Futures studies and forecasts.

Master's course. Responsible persons: Mattias Höjer and Ulrika Gunnarsson

Life Cycle Assessment

Master's course. Responsible person: Anna Björklund.

Planning the Sustainable City

Master's course. Responsible person: Örjan Svane and Sylvia Dovlén.

Other courses

Besides the above mentioned courses, personnel from fms gives lectures in a number of courses both within the School of Architecture and the Built Environment, other schools at KTH and at other Universities.

Publications 2006 and early 2007

Publications in peer reviewed scientific journals

Ahlroth, S. and Höjer, M. Sustainable energy prices and growth: Comparing macroeconomic and backcasting scenarios. *Ecological Economics*, 2007, 63:722-731

Åkerman, J. and Höjer, M. (2006): How much transport can the climate stand? Sweden on a sustainable path in 2050. *Energy Policy* 34, 1944-1957

Björklund, A. and Finnveden, G. (2007): Life cycle assessment of a national policy proposal – The case of a proposed waste incineration tax. *Waste management*, 27 (8), 1046-1058.

Börjeson, L., Höjer, M., Dreborg, K.-H., Ekvall, T. and Finnveden, G. (2006): Scenario types and techniques - Towards a user's guide. *Futures*, 38, 723-739.

Byggeth S and Hochschorner E (2006): Handling trade-offs in Ecodesign tools for sustainable product development and procurement. *Journal of Cleaner Production* 14, 1409-1419

Ekvall, T., Assefa, G., Björklund, A., Eriksson, O. and Finnveden, G. (2007): What life cycle assessment does and doesn't do in assessments of waste management. *Waste management*, 27 (8), 989-996.

Engström, R. and Wadeskog, A. (2006): Environmental impact from a sector: production and consumption of energy carriers in Sweden. *Progress in Industrial Ecology*, 3, 451-470.

Engström, R., Wadeskog, A. and Finnveden, G. (2007): Environmental assessment of Swedish agriculture. *Ecological Economics*, 60, 550-563.

Eriksson, O., Finnveden, G., Ekvall, T. and Björklund, A. (2007): Life Cycle Assessment of fuels for district heating. A comparison of waste incineration, biomass and natural gas combustion. *Energy Policy*, 35, 1346-1362

Finnveden, G., Björklund, A., Moberg Å. and Ekvall T. Environmental and economic assessment methods for waste management decision-support: possibilities and limitations. *Waste Management & Research*, 2007, 25, 263-269.

Finnveden, G., Björklund, A., Carlsson Reich, M., Eriksson, O. and Sörbom, A. (2007): Flexible and robust strategies for waste management in Sweden. *Waste Management*, 27 (8), S1-S8.

Finnveden, G., Eldh, P. and Johansson, J. (2006): Weighting in LCA Based on Ecotaxes – Development of a Mid-point Method and Experiences from Case Studies. *Int J LCA*, 11, Special issue No 1, 81-88.

Hochschorner, E. and Finnveden, G. (2006): Life Cycle Methodology in the acquisition process of Defence Materiel. *Int J LCA*. 11, 200-208.

Hochschorner, E., Hägwall, J., Finnveden, G., Griffen, E. and Overcash, M. (2006): Environmental Life Cycle Assessment of a Pre Fragmented High Explosive Grenade. *Journal of Chemical Technology and Biotechnology*, 81, 461-475

- Höjer, M., Ahlroth, S., Dreborg, K.-H., Ekvall, T., Finnveden, G., Hjelm, O., Hochschorner, E., Nilsson, M., Palm, V. (2007): Scenarios in environmental systems analysis tools. Submitted.
- Malmqvist, T. and Glaumann, M. (2006): Selecting problem-related environmental indicators for housing management. *Building Research & Information*, vol 34, issue 4, pp. 321-333.
- Palm, V., Wadeskog, A. and Finnveden, G. (2006): Swedish experiences of using environmental accounts data for integrated product policy (IPP) issues. *Journal of Industrial Ecology*, 10 (3), 57-72.
- Sundkvist, Å. and Finnveden, G. (2007): Stakeholder needs study on indicators for IPP (Integrated Product policy). *J Cleaner Production*, 15, 323-326.
- Svane Ö & Weingaertner C 2006: MAMMUT – Managing the Metabolism of Urbanization: Testing theory through a pilot study of the Stockholm Underground. Paper accepted for publication in *Sustainable Development*, Electronic version available at: <http://www.interscience.wiley.com/> (EarlyView®)
- Svane Ö 2006: Situations of Opportunity – Hammarby Sjöstad and Stockholm City's Process of Environmental Management; Accepted for publication, *Corporate Social Responsibility and Environmental Management*, Wiley & Sons Ltd.
- Wallgren, C. (2006): Local or Global Food Markets - A Comparison of Energy Use for Transport. *Local Environment* 11(2) 233-251.

Other printed material

- Björklund, A., Finnveden, G., Dreborg, K.-H., Johansson, J., Mårtensson, A., Stenlund, J., Viklund, P., and Wiklund, H. (2006) *Energiplanering med strategisk miljöbedömning i Finspång. Linköpings universitet, LiTH-IKP--06/1418—SE.*
- Cabrolle, P. (2006): [Suggestion of generic Product Category Rules \(PCR\) for new buildings](#) 116 sid. Master of Science Thesis SOM-EX 06:013
- Dreborg, K.H. och Jonsson, D.K. (2006): *Självförstärkande processer i transportsystemet. Naturvårdsverket.*
- Ekvall, T., Assefa, G., Björklund, A., Eriksson, O., and Finnveden, G. (2007) *Limitations and amendments in life-cycle assessment on waste management. Presented at the 20th Sardinia Symposium, Sardinia, Italy.*
- Engström, R. (2006): [Food, energy and the environment from a Swedish perspective.](#) 72 sid. Doctoral Thesis TRITA-SOM 06:009, ISBN 91-7178-438-1
- Engström, R. (2007): Sector Environmental Analysis of Energy and Agriculture. In Nilsson, M. and Eckerberg, K. (Eds.): *Environmental Policy Integration in Practise. Shaping Institutions for Learning*, 67-84. Earthscan
- Finnveden, G. (2007): Några reflektioner på rapporten ”Underlag till utvärdering av producentansvaret för förpackningar”. 8 sid. TRITA-INFRA-FMS 2007:3, ISSN 1652-5442

Finnveden, G., Björklund, A., Ekvall, T., and Moberg, Å. (2006) Models For Waste Management: Possibilities And Limitations. Presented at the annual ISWA congress, Copenhagen, 2006.

Finnveden, G. and Sterner, T. (2007): Reflektioner på samhällsekonomiska analyser i allmänhet och på kalkylen för nord-sydliga förbindelser i Stockholm i synnerhet. 17 sid TRITA-INFRA-FMS 2007:1, ISSN 1652-5442

Finnveden, G., Wadeskog, A., Ekvall, T., Engström, R., Hjelm, O. and Palm, V. (2007): Miljödata för produktgrupper - Användning av Input-Outputanalyser i miljöstrategiska verktyg 24 sid TRITA-INFRA-FMS 2007:4, ISSN 1652-5442

Glaumann M. *Sustainability – different assessment methods give different answers*. Action for Sustainability – Sweden builds for the future. p 19-23. ISBN 91-540-5964-X The Swedish Research Council Formas. Brochure 1:2006

Gunnarsson, U., Höjer, M. och Dreborg, K.-H. (2006): [Att använda scenarier - förslag till långsiktigt miljömålsarbete](#). 69 s. TRITA-INFRA-FMS 2006:3, Stockholm: KTH Samhällsplanering och miljö

Henriksson, G. (2006) Stockholmsförsöket – individuella resvanor i blyxtbelysning. www.ne.se (A web-based article in Swedish about the Stockholm Trial where it's possible to search with words: *trängselskatt, resvanor*)

Hochschorner, E., Hägwall, J., Roth, L., Tryman, R. and Finnveden, G. (2006): Reference report on the use of environmental life cycle methodologies in procurement in the Swedish defence. 89 pages. Stockholm, Swedish Defence Research Agency/FOI, FOI-R -- --SE, ISSN 1650-1492.

Jonsson, D.K. (2006): [Situations of opportunity for Infrasystems. Understanding and pursuing change towards environmental sustainability](#). Doctoral Thesis TRITA-SOM 06-10, ISBN 91-7178-465-9.

Jonsson, D.K., Finnveden, G., och Lundqvist, L. (200): Bedömning av inverkan på transporter och energi i Statens offentliga utredningar: Analys av några SOU:er och förslag på metodik för att underlätta framtida miljöbedömning. Rapport 5864. Naturvårdsverket.

Moberg, Å. (2006): [Environmental systems analysis tools for decision-making - LCA and Swedish waste management as an example](#). 56 sid. Licentiate Thesis TRITA-SOM 06:002

Nilsson, M., Eckerberg, K. and Finnveden, G. (2007): Discussion: What Enabled EPI in Practise?: . In Nilsson, M. and Eckerberg, K. (Eds.): Environmental Policy Integration in Practise. Shaping Institutions for Learning, 137-161. Earthscan

Paglia, E. (2006): [Investigating the Environmental Paradox: The Role of Newly Generated Traffic in Decision-making Tools for Road Infrastructure Investments in Sweden](#). 48 sid Master of Science Thesis SOM-EX 06:028

Roth L., Björklund, A. and Finnveden, G. (2007): Förutsättningar för ökad insamling och materialåtervinning av hushållens säck och kärlavfall i materialströmmar 26 sid TRITA-INFRA-FMS 2007:2, ISSN 1652-5442

Sundkvist Å, Eriksson O, Glaumann M, Bergman S, Finnveden G, Stenbeck S och Wintzell H (2006) Miljöklassning av byggnader - Inventering av metoder och intressenters behov. TRITA-INFRA-FMS 2006:1

Svane Ö & Weingaertner C 2006: MAMMUT – Managing the Metabolism of Urbanization: Testing theory through a pilot study of the Stockholm Underground. Sustainable Development, Vol 14, no 5, 312-327; John Wiley & Sons Ltd.

Swartling, Å.G., Nilsson, M., Engström, R. And Hagberg, L. (2007): Theory and Methodology for EPI Analysis. In Nilsson, M. and Eckerberg, K. (Eds.): Environmental Policy Integration in Practise. Shaping Institutions for Learning, 49-65. Earthscan.

[Verksamhetsberättelse Avdelningen för miljöstrategisk analys – fms 2005](#). TRITA-INFRA-FMS 2006:2

Wallgren, C. (2006): Transports of locally produced food in Järna. In: Granstedt, A., Thomsson, O. and Schneider, T.: Environmental impacts of eco-local food systems - final report from BERAS WorkPackage 2, pp. 78-86.

Conferences and seminars – a selection

Sofia Ahlroth

Presentations:

Generic values for ecosystem effects in Sweden

Seminar at SLU, Dep of forest economics. March 2006

Testing benefit transfer by preference calibration: applications to Sweden

Ulvön Conference on Environmental Economics. June 2006

Benefit transfer by preference calibration

Seminar at Umeå University, Dep of Economics. Nov 2006

Mauritz Glaumann:

Glaumann, G., Sundkvist, Å., Malmqvist, T., Finnveden, G. and Eriksson, O. 2006.

Development of an environmental classification system for buildings through a new kind of dialogue between stakeholders and researchers. Conference paper, Environment, Health and Sustainable Development.- 19th IAPS International Conference, 11-16 September 2006.

Bibliotheca Alexandria, Egypt.

Ulrika Gunnarsson:

Seminar at the department of Urban planning and environment, KTH: **Environmental justice – a new perspective on Swedish sustainability and planning research?** Together with Karin Bradley and Karolina Isaksson. February 24, 2006.

Arranging a series of five seminars on **Planning for sustainability and justice** together with the research group Space – Power – Meaning at Stockholm City Planning Administration. June – November 2006.

Presentation of the paper **Just urban form** at AESOP PhD workshop in Bristol, UK. July 2006.

Introduction to workshop on **Gender equal planning**, Stockholm county administrative board, 30 August 2006.

Tove Malmqvist

To evaluate user satisfaction and environmental impact simultaneously in buildings.
Konferens: 19th iaps International Conference "Environment, Health and Sustainable Development". Sept 11-16, 2006. Alexandria, Egypten.

Örjan Svane

Svane Ö 2006: ...but most buildings are already there. Basic starting points for environmental management in the housing sector; Paper, ENHR Conference, Ljubljana.

2007 ENHR, Rotterdam, Paper and presentation, invited seminar leader.
Engberg L & Svane Ö 2007: Compromise, failure or necessity– analysing the brownfield development of Hammarby Sjöstad, Stockholm, as Negotiated Sustainability processes in Governance Networks.

Jonas Åkerman

Hållbart flygresande 2050 - Transportsektorns största utmaning?, Jonas Åkerman, presentation at the conference Transportforum, January 2006 in Linköping.

Energieffektivt och hållbart flygresande år 2050, Jonas Åkerman, presentation at the conference *Energi, IT och Design*, hosted by the Swedish Energy Agency in Eskilstuna, January 2006.

Flyget och oljan, Jonas Åkerman, presentation at a hearing with the Commission against oil dependence, 17 February 2006 (broadcasted in TV-24).

Hållbart flygresande år 2050 – Sveriges största klimatutmaning?, Jonas Åkerman, presentation for the The Committee on Transport and Communications in the Swedish Parliament , 9 March 2006 (broadcasted in TV-24).

Färder i framtiden – Hållbara transporter 2050?, Jonas Åkerman, presentation at seminar held by Atkins in Lund, 29 March 2006.

Flyget ur ett hållbarhetsperspektiv – Med klimatpåverkan i fokus, Jonas Åkerman, presentation at seminar held by Gateway Stockholm, Arlanda 5 April 2006.

Flyget, klimatet och flygskatten, Jonas Åkerman, presentation at seminar held by the environmental network GLOBE of the Swedish parliament, 6 April 2006.

Smart Urban Fabrics - Några inledande perspektiv, Jonas Åkerman, Presentation at seminar at the Ministry of the Environment, 25 April 2006.

Sustainable air transport – On track in 2050, Jonas Åkerman, presentation at the conference Tourism and Climate Change hosted by NHTV in Holland 11-12 June 2006.

Hållbara svenska transporter 2050, , Jonas Åkerman, presentation at seminar held by the Swedish Energy Agency, Gothenburg, 27 June 2006.

Transporter, klimat och sårbarhet, Jonas Åkerman, presentation at seminar held by ”Klimat -och sårbarhetsutredningen”, 2006.

Flyget och dess klimatpåverkan, Jonas Åkerman, presentation at seminar held by the environmental committee of ”Svenskt flyg”, 14 September.

Hållbara transporter 2050, Jonas Åkerman, presentation at ECO2 seminar, 8 November.

Appereances in massmedia – examples

The Stockholm Trial project was, particularly before the referendum, payed attention to in daily papers, Swedish television (SVT24) and radio (P4 and others) where Greger Henriksson particiapated.

Jonas Åkerman has appeared a lot in Swedish media especially regarding the climate impact of avaiation.:

* Radio debate in the programme ”P1 morgon” regarding the climate impact of aviation and possible measures to reduce the emissions, 18 April.

* Own articles in daily journals: Article on the climate impact of aviation, Svenska Dagbladet, Brännpunkt, 16 April 2006 together with Stefan Gössling, Lund university.

* Interviews in newspapers. (Mostly about the climate impact of aviation):

Dagens Nyheter, Resor, 12 March

Arbetaren, 24 March-30 March.

Vagabond No 1, 2006.

Göteborgs-Posten, 29 September.

Sydsvenskan, 8 October.

Expressen, 12 November.

Stockholm City, 20 November.

Svenska Dagbladet, 3 December.

MiljöAktuellt, Nr 10, 13 December.

Other impact on the public debate

Cited in the Swedish Parliament by the Minister for Finance, Pär Nuder, 15 May (regarding the rapid increase in emissions of greenhouse gases from aviation)

Positions in boards etc

Anna Björklund

- Member of the International Expert Group on Life Cycle Assessment and Integrated Solid Waste Management.

Göran Finnveden

- Member of the board of the Nordic Life Cycle Association
- Member of the Swedish Environmental Protection Agency's Waste Council.
- Member of the board of the KTH Centre for Sustainable Communications (2006).
- Member of the editorial board of the International Journal of Life Cycle Assessment.
- Member of the editorial board of the Journal of Cleaner Production.
- Member of the editorial board of Progress in Industrial Ecology.
- Member of the International Expert Group on Life Cycle Assessment and Integrated Solid Waste Management.
- Member of the working group on Life Cycle Impact Assessment within the SETAC/UNEP Life Cycle Initiative.
- Member of the Advisory Board of the Working Group on Modeling and Evaluation for Sustainability.

Mauritz Glaumann

- Member of COST C25 "Sustainability of constructions"
- Member of International Initiative for Sustainable Built Environment.

Ulrika Gunnarsson

- Member of the board of the Centre for Sustainable Communication at KTH.

Mattias Höjer

- Member of the board of The National Board of Housing, Building and Planning – Boverket

Örjan Svane

- Member of the Advisory Board on Building of SP Technical Research Institute of Sweden, Borås.
- Member of the Editorial Board of the Scientific Journal Sustainable Development, Wiley & Sons Ltd.

Marita Wallhagen

- Chairman of the Swedish Association of Architects in Gävle-Dalarna

Hit lists – examples

Several scientific journals have “hit lists” on the most downloaded papers in their journal. The appearance on such lists indicate that the paper is read and of interest. Below are examples of our papers that have appeared on different hit lists during 2006.

Åkerman, J. and Höjer, M. (2006): How much transport can the climate stand? Sweden on a sustainable path in 2050. *Energy Policy* 34, 1944-1957
Was number 17 in September 2006.

Björklund, A. (2002): Survey of Approaches to Improve Reliability in LCA. *Int J LCA*, 7, 64-72.
The paper is on place 19.

Björklund, A. and Finnveden, G. (2005): Recycling revisited – life cycle comparisons of global warming impact and total energy use of waste management strategies. *Resources, Conservation and Recycling*, 44, 309-317.
The paper was on place 18 in March 2006.

Börjeson, L., Höjer, M., Dreborg, K.-H., Ekvall, T. and Finnveden, G. (2006): Scenario types and techniques - Towards a user's guide. *Futures*, 38, 723-739.
The paper was on place 2 in September 2006.

Eriksson, O.; Carlsson Reich, M.; Frostell, B.; Björklund, A.; Assefa, G.; Sundqvist, J.-O.; Granath, J.; Baky, A.; Thyselius, L. (2005): Municipal solid waste management from a systems perspective. *Journal of Cleaner Production*, 13, 241-252.
The paper was on place 4 in June 2006

Finnveden, G. (2000): On the limitations of Life cycle Assessment and Environmental Systems Analysis Tools in General. *Int. J. LCA*, 5, 229-238.
The paper is on place 6.

Finnveden, G.; Johansson, J.; Lind, P.; Moberg, A. (2005): Life Cycle Assessment of Energy from Solid Waste – Part 1: General Methodology and Results. *Journal of Cleaner Production*, 13, 213-229
The paper was on place 12 in March 2006

Hochschorner, E. and Finnveden, G. (2003): Evaluation of Two Simplified Life Cycle Assessment Methods. *Int J LCA*, 8, 119-128.
The paper is on place 14.

Contact

The Division of Environmental Strategies Research - fms is located at KTH Campus in central Stockholm, [which is here »](#)

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More information

If you want to know more about fms you'll always find the newest information on our web site. Here you can learn more about our projects, down load the latest publications and find contact information. Visit: <http://www.infra.kth.se/fms>

You can also contact us by e-mailing to: fms.info@infra.kth.se