Joint Actions on Climate Change

Conference Proceedings

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Publication date:
2009

Document Version
Publisher's PDF, also known as Version of record

Joint Actions on Climate Change

8-10 June 2009, Aalborg, Denmark

www.jaocc.net

Conference Proceedings

"Joint Actions on Climate Change" is a joint endeavour of:

European Roundtable for Sustainable Consumption and Production 13,
The Greening of Industry Network 2009
SCORE!
Nordic Life Cycle Association
Euro Sustainability

Published by
Department of Development & Planning
Aalborg University
Fibigerstræde 13
DK - 9220 Aalborg Ø
Edited by R.D. Andersen; M. Lehmann

Enclosed conference abstracts, papers and conference programme
ISBN 978-87-91830-30-3

The organisers of Joint Actions on Climate Change would like to thank all sponsors and supporters of the conference:
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Forskningsrådet for Samfund & Erhverv
Danish Development Research Network

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Almut Reichel, European Environmental Agency, Copenhagen and Mikkel S. Hansen, Topic Centre on SCP, Copenhagen, Denmark

Text not available

2.1 Effectiveness of policy instruments for SCP

Arnold Tukker, Innovation and Environment, TNO, Delft, Netherlands

Based on a report by Arnold Tukker, Fernando Diaz-Lopez, Martin van de Lindt (TNO, Delft, the Netherlands), Oksana Mont (International Institute of Industrial Ecological Economics, Lund University, Lund, Sweden)' Sylvia Lorek, Joachim Spangenberg, Stefan Giljum (Sustainable Europe Research Institute, Cologne/Vienna, Germany/Austria)

Under the EU's FP6, TNO, SERI and Lund University performed a project analysing the effectiveness of policy instruments for SCP (SCOPE2). The project looked at:

business initiatives

policy instruments

systemic approaches

The project did a gap analysis and combined the information from the 3 fields above to conclusions, in the form of a matrix of actors and instruments. This was specified for the domains food, mobility and housing/energy use. Instruments are divided into established instruments, under-explored instruments, and *innovative instruments* (color codes used in the tables in the report). Some illustrative examples include:

Housing/energy use

Establish a top runner scheme for housing/houses (EU)

Exercise sustainable public procurement for public buildings and their energy supply (governments);

Development of standards for zero-energy houses (EU, governments)

Mobility

Establish a top runner scheme in the automotive field (EU)

Implement congestion charges; develop infrastructure for non car mobility (local and regional governments, national governments)

Adapt fuel pricing (particularly for aviation) (EU)

Food

High VAT on food products with high environmental impacts (e.g. meat) (EU, national governments)

Informative campaigns influencing meat consumption levels (EU, national governments)

Making impact of food visible (e.g. via carbon footprint labels; retailers).

Apart from the domain-specific recommendations, some general policy recommendations can be given. Where they seem obvious rules for professional policy making, our findings show that in the SCP they are only partially applied. These include:

Ensuring adequate stakeholder involvement, impact on decision-making. This element is usually well organised in most EU member states and at EU level;

Development of clear multi-dimensional sustainability targets. There is a clear reluctance to set such goals in an SCP context (e.g. targets with regard to overall resource-efficiency improvements in society)[1];

Clear agreements on implementation steps to be taken by different agents. Given the widely experienced 'implementation gap' in the field of SCP, also this point needs attention.

Implementation control, success monitoring and feedback loops. This is partially covered at national and EU level by institutions such as EUROSTAT and the EEA (and similar ones at national level).

Finally, it has to be repeated that SCP is a concept that de facto seeks to make our economic system as a whole more sustainable. Though this is usually neglected, it hence must address some fundamental questions about how the economic system works, and if it provides quality of life for the masses in the most effective way. Dealing with topics such as 'beyound GDP', 'degrowth', and 'effectiveness in quality of life provision' hence must have a place on the SCP agenda, how difficult they may be to deal with.

[1] In the economic field, the situation is markedly different. There is agreement on e.g. targets with regard to inflation, state debt, etc., that reflect a 'healthy economy'.

2.2 Evaluating Sustainable Consumption Policies and Practices: Gaps, white spots and future developments

Oksana Mont[1], Arnold Tukker[2], Sylvia Lorek[3], Fernando Diaz-Lopez,[2], Joachim Spangenberg[3], Martin van de Lindt[2], Stefan Giljum[3], Martin Bruckner[3] and Ines Omann[3], (1)International Institute for Industrial Environmental Economics, Lund University, Lund, Sweden; (2)Innovation and Environment, TNO, Delft, Netherlands; (3)SERI Germany e.V., Overath, Germany

A new mandate for sustainable consumption and production (SCP) was created at the Johannesburg Summit in 2002 by calling for the development of a 10-year Framework of Programs on Sustainable Consumption and Production. In 2006 EU Sustainable Development Strategy was revised to include sustainable consumption and production and last year, in 2008, European Commission published an Action Plan on sustainable consumption and production (EC, 2008). Thus, the issue of sustainable consumption and production has been finally gaining momentum in the European policy arena. There is therefore a great demand for insight into what existing and potential policy instruments are best suited to support SCP.

A European project Sustainable Consumption Policies Effectiveness Evaluation (SCOPE2) has been conducted under the EU's 6th Framework Programme to assist with this task. The project included an inventory and analysis of the effectiveness of policy instruments, voluntary business initiatives for sustainable consumption and production and more systemic approaches to realise SCP. A gap analysis was then performed that focused on gaps of effectiveness (how instruments and approaches can be applied more effectively, alone or in combination), on sectoral (housing, mobility and food) and geographical gaps and on white spots of new instruments and approaches that seem necessary for furthering sustainable consumption and production, but are not applied yet anywhere. The project identified short, middle and long-term goals, means and problems with reaching various levels of sustainable consumption and production from a systemic perspective. It furthermore developed recommendations for how policy, business and more systemic efforts can be undertaken to promote SCP and which political actors should be involved in specific activities. This contribution reports the outcomes of the project.

3.1 Consumer decision-making regarding a "green" everyday product

John Thøgersen, Anne-Katrine Jørgensen and Sara Sandager, Aarhus School of Business, Aarhus University, Aarhus V, Denmark

When shopping for common, everyday consumer goods, consumers make decisions about brand choice in an extremely time-efficient way using simple, well-learned choice heuristics (Hoyer, 1984). Consumers are often assumed to be more involved when choosing "green" products, but does adding a "green" attribute actually make so much difference? Does it change the way consumers make decisions when buying groceries or do they just develop another, simple choice heuristics? Based on observation and follow-up interviews of consumers at the milk fridge in supermarkets, we conclude that consumers basically make their decision the same way irrespective of whether they by "green" (i.e., organic) or conventional milk. Consumers buying the "green" product are more likely than others to use multiple criteria in their choice, but the overall amount time and effort devoted to the decision-making in the store is not higher. However, about half of the consumers choosing the "green" alternative seem to have developed a choice heuristic based on the "green" attribute. Another nine percent said that they had developed a habit of buying the "green" product. Hence, rather than changing the way consumers make decisions when buying groceries, "green" attributes seem to lead to the development of new, simple choice heuristics or to the adaption of time-proven choice tactics, such as habit.

3.2 Energy consumption in organizations – An intervention to change routines

Ellen Matthies[1], Nadine Hansmeier[2] and Hermann-Josef Wagner[3], (1)Dept. of Psychology, Ruhr-University, Bochum, Germany; (2)Dept. of Psychology, Ruhr-University Bochum, 44780 Bochum, Germany; (3)Dept. of Engineering, Ruhr-University, Bochum, Germany

To achieve a sustainable reduction of carbon dioxide emissions diverse solutions have to be considered. Besides technical solutions the promotion of energy efficient behavior may lead to a significant reduction of emissions. For public buildings the potential that lies in a more efficient energy behavior is assumed to range from 5 to 15% of the total energy consumption of a building (e.g. for schools or administrative buildings).

In order to tap this potential, the inter- and transdisciplinary project "change" has been set up. It is supported by the German Federal Ministry of Education and Research (BMBF). Its objective is to develop an internet based consultancy tool for public buildings. The project combines the expertise of environmental psychology and engineering with the practical knowledge and networking activities of a central consulting organization for institutions of higher education (HIS). As a first step an intervention program, based on calculated potential energy savings and on a set of target-shaped intervention techniques, has been designed and evaluated in cooperation with four German universities. First results will be presented.

4.1 The SuFiQuaD project - Sustainability, Financial and Quality evaluation of Dwelling types

Carolin Spirinckx[1], An Vercalsteren[1], Theo Geerken[1], Karen Allacker[2] and Frank De Troyer[2], (1)Unit Transition Energy and Environment, VITO - Flemish Institute for Technological Research, Mol, Belgium; (2)Catholic University of Leuven, Department of Urban Planning and Architecture, KULeuven - ASRO, Leuven, Belgium

The four-year project SuFiQuaD has started in 2007 to develop a methodology that can be applied to optimize the Belgian dwelling stock. SuFiQuaD stands for **Su**stainability, **Fi**nancial and **Qua**lity evaluation of **D**wellings. The aim of the project is to optimize buildings considering their environmental impact, their financial cost and the quality they offer over the whole life cycle, from the production of primary raw materials to the final demolition and end-of-life treatment. In the first phase of the project the optimization methodology is developed: environmental impacts are analyzed by means of a life cycle assessment (LCA). The environmental impacts are then translated into environmental costs using a monetary valuation of the environmental impacts; financial costs are calculated based on life cycle cost (LCC) analyses; and the quality evaluation is based on multi-criteria analyses. The optimization of the three aspects (environmental costs, financial costs and qualities) is based on a Cost Benefit Analysis (CBA). By means of the CBA it is possible to identify the highest marginal quality improvement for the lowest additional financial and environmental costs. The developed methodology is translated into a tool and applied in this first phase of the project to a limited selection of dwelling types. In the second phase of the project, the methodology and tool will be applied to a series of representative dwelling types for the Belgian dwelling stock. The presentation at the ERSCP 2009 will elaborate on the developed methodology and the results of the first implementation with some selected dwelling types.

4.2 Integration of LCA and LCC for decision making in sustainable building industry

Guoguo Liu, Department of civil and environmental engineering & Department of energy and environment, Chalmers University of Technology, Gothenburg, Sweden

Climate problem should be seen as a big issue nowadays. With environment change dramatically these years, we must focus more on how to keep balance between ecology system and our society. It is necessary to joint endeavor bringing all stakeholders involved in developing solutions to climate change and research disciplines together in order to building a bridge between different views and positions and find a feasible solution.

Since the last two or three decades, there has been a gradually increasing interest for the impact that human activities have on the environment in construction industry, because building sector is one of the key sectors in the pursuit of a sustainable society. According to statistic data, buildings are accountable for approximately 40% of society's total environmental impact. Interference with the natural environment occurs during all phase of the building process. Although the green ideas of building sector have been introduced for several years, different groups have chosen to focus on different aspects and thus depending on the context and the actors, green construction cannot be realized easily. Many organizations are now expected to have a feasible consult tool which can take both environmental and economic impact into account. During my master study, through learning relevant knowledge of construction engineering and environmental science, I get an idea that is to find a solution which can provide optimal decision in building sector based on a combination of results of integration of LCA and LCC research. The entire research is divided into three main steps:

Firstly, analyze characteristic of LCA and LCC respectively then compare and conclude similarities and differences between them. In the beginning of my research, I focus on what are LCA and LCC's procedures, what are the objectives they have research on and how to use them in building sector as well as providing suggestion to decision makers. Through basic understanding of them, it is easy to find connection between each other. The similarities of them are: 1. LCA and LCC play important roles in design phase; 2. Both of them can help reducing environmental impact and energy consumption of building in the future. The differences are their research objectives and research methodology.

Secondly, judge whether it is possible to integrate them. Compare to LCA and LCC, we can see clearly that LCA is concern on environmental impact but LCC is for economic value. How to integrate economic consideration with environmental assessment is complex, but it has a profound meaning to achieve sustainable building. In additional, construction materials and installations decide environmental impact and energy consumption of building in the usage phase as well as occupy some portion of total cost in construction procurement. It is necessary to consider the property of construction materials in design phase both from environmental and economic aspects. Hence, construction materials and installations can be regarded as a connection point of LCA and LCC. Finally, develop this integrated tool that offers client and other participators in building sector a better decision. The result of my research has shown two ways of integration. On one hand, it is possible to establish an impact and cost database for the dominant range of building and services components and materials, which facilitate building designers to choose right materials in the beginning. A fully developed database information system is meant to be a basis for carrying out different scenarios, like how much can the emission of CO_2 or hazard gas be reduced with materials alternatives? What kinds and what amounts of waste can we expect in the next 25 years? What is the potential for applying solar energy system to the façade or roof of building? Is it economic to change installation or refurbishment of the building couple years later? ; On the other hand, we will use VE/LCC and LCA for the decision making process to select the most proper alternative and integrated decision making tool is V (Value) = F (Function)/(C (Cost)*E (Environmental assessment)).

While, through survey of building sector, life cycle technology and management had better be used in pre-design and design phase, which means it only offers suggestion to designer, technical engineers and clients. To achieve a completely sustainability, we still need adopt environmental management in construction phase and spread sustainable idea among tenants. Therefore, how to set up an acceptable system combining life cycle technology and environmental management is an important issue in developing sustainable building industry, which needs further research and more communication with stakeholders.

14.1 Systemic Approaches to Innovation: some lessons to Sustainable Consumption and Production (SCP)

Fernando Javier Diaz Lopez, Arnold Tukker and Martin van de Lindt, Building Environment and Geosciences, BU Innovation and Environment, TNO, Netherlands Organisation for Applied Scientific Research, Delft, Netherlands

Systemic approaches to innovation: some lessons for Sustainable Consumption and Production (SCP)[*] Sustainable consumption and production can be regarded as one of our current and largest societal challenges. However, the road towards a sustainable consumption and production system is a very complex one. The challenge of achieving sustainable consumption and production presents our society with the need for long-term, structural changes in consumption areas such as: mobility, agro-food, and energy use in and around housing. These tree areas are responsible for 70% of the life cycle environmental impacts of Western societies (EEA 2005; Tukker, Huppes et al. 2006). Changes in consumption and production patterns are not caused by a single factor, but the result of different types of social-cultural, technical and economic developments (e.g. individualisation, growing incomes, globalisation of the economy, etc). Since multiple factors cause change, it is likely that simple policy approaches will not lead to more sustainable consumption and production patterns (Tukker 2008). Consumers are often not as sovereign as they might think, since their behaviour is shaped by factors they cannot influence. The same applies for businesses: they are embedded in a system that rewards profit, sales of material goods, growth, using externalities, and so on. A more systemic and holistic perspective seem to be necessary to analyse these persistent consumption and consumption problems. In this way, new forms of complex and reflexive governance could possibly be best suited to solve these problems and be considered as the logical next phase in the evolution of policy making. This in order to understand how policy instruments can lead to greening of the markets and stimulate more sustainable consumption patterns by individuals and households. A review of systemic and holistic theories that could contribute to SCP is hence desired

A variety of theories takes a more overarching view on consumption and production. They look at *systems* of consumption and production, their institutional setting, and how government and other forms of governance can change this. In particular, we distinguish two main system-related concepts that could be useful for the SCP field: the *system innovation* approach (Rotmans, Kemp et al. 2000; Geels 2002; Loorbach 2007), and the *innovation systems* approach (e.g. Freeman 1987; Lundvall 1992; Nelson 1993; Breschi and Malerba 1997; Edquist 1997; Cooke 2001; Hekkert, Suurs et al. 2007). The empirical focus of the former approach is on 'system innovations'. It sees a partly locked-in, interdependent mainstream regime of technical artefacts, user practices, infrastructure, values; a niche level with novel practices, and a landscape that moulds the degrees of freedom of the regime. Regimes hence usually change in an incremental way. The system innovation approach has, since its origins, a sustainability driver. The empirical focus of the latter approach places knowledge, innovation, and (interactive) learning as core aspects within a well structured network of actors. It is interested in understanding development and diffusion of innovation. This approach argues that the right mix of knowledge infrastructure, entrepreneurship, risk capital, launch markets etc. must be in place. The innovation systems approach is not necessarily focused on sustainability issues, albeit some important contributions to the SCP agenda could be derived from a systemic and holistic use of this approach (Andersen 2008)

It has been acknowledged that policy intervention is acceptable when individual actors or markets do not achieve objectives that from an overall society perspective are desirable (Edquist and Chaminade 2006). Traditional policy approaches imply the application of regulatory, economic and informative instruments that adjust framework conditions. Often, a single instrument or a limited mix of instruments is applied that has to do the trick: a 'silver bullet' that changes market and framework conditions is asked for, in the hope that such changes in market and framework conditions create a dynamics that makes consumption and production more sustainable. Systemic theories to innovation focus on failures in the socio-economic system, which is so much broader than the interaction in a production-market-consumption value chain. It is such 'system failures' that are addressed by systemic instruments.

The main idea behind the use of systemic instruments is that they truly differ from traditional policy –they are realistically achievable but require great coordination efforts. Clearly, the use of systemic instruments might allow the identification of targeted solutions for specific problems but they would also attempt to tackle the problem as a whole. The functioning of the system can be understood, framework conditions can be enhanced, specific areas can be targeted, broad (technology) areas can be developed, market and societal penetration is facilitated, and system change is intended. If technologies or social instruments are targeted towards amending specific social demands, behavioural change can be induced. Ultimately, the use of systemic instruments may lead to a 'tailor made' approach for amending system failures that would contribute to producer and consumer behavioural change. SCP is a systemic challenge where the application of individual, traditional policy instruments is not always sufficient. Systemic failures hinder changes to SCP, and hence systemic instruments are needed.

This paper seeks to provide lessons from systemic approaches to innovation that could be useful for the SCP domain. In order to do so, two strands of theories and a number of related cases (from the mobility, agro-food, and energy use in and around housing domains) are discussed and analysed – In particular, exemplary cases where systemic theories of change were the basis for policy intervention. This paper makes a contribution from the system innovation approach to the SCP literature by exemplifying the added value of policy interventions done with a systemic mindset, the specific characteristics of systemic instruments, and general lessons and implications for SCP policies derived from a number of cases. Finally, some shortcomings of the aforementioned approaches are also highlighted (in relation to its applicability to SCP).

(*) This paper is based on results from the European project Sustainable Consumption Policies Effectiveness Evaluation (SCOPE2). This project is being conducted under the EU's 6th Framework Programme in order to contribute to a deeper understanding on how to promote SCP.

14.2 Innovative Approaches to Strengthen Sustainable Consumption

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The background

Despite comprehensive policy actions, the negative impacts of the consumption societies remain on the increase. The trend urges a rethinking of SCP policies. Particularly opportune in this respect would seem a shift in the focus of SCP policies; a shift from on production and products to *consumption*. Indeed, a gradual shift in the interests of policy makers from production towards consumption may be taking place. This paper explores this shift from the angle of policy instruments. This is done while providing an analytical framework, with which the most pertinent characteristics of promising sustainable consumption instruments are extracted. On the basis of these findings, suggestions will be provided for further improving policies on sustainable consumption.

This paper will be based on the EU funded research project "ASCEE" ("Assessing the potential of various instruments for sustainable consumption practises and greening of the market" February 2007 - November 2008). It was co-ordinated by IÖW and carried out together with IES, Brussels, and SIFO, Oslo.

Empirical findings

There are few national action plans, or at least framework programmes, that address SCP specifically (e.g. Finland, United Kingdom, Sweden). Sometimes these SCP strategies represent further developments of previous strategies on Integrated Product Policy. Although there thus appears to be a lack of integrated and cohesive strategies on sustainable consumption, countries, such as Germany, or Denmark employ a wide range of policy instruments relevant for such a strategy.

ASCEE concentrated on policy instruments that promote sustainable consumption practices and contribute to a greening of the market. The focus was on innovative policies and top-down instrument approaches. Only few completely new instruments to SC policy were encountered. The British Red/Green Calculator and the Finnish Eco-Benchmark tool are examples of instruments that are innovative in this narrow sense. Instruments which are (merely) new to a specific application context were encountered more often. Examples include the diffusion of the "TopTen" internet platform from Switzerland to other European countries, or the uptake of Green Public Procurement.

Core strategy

This paper will provide a framework for processing and illuminating the latest policy interventions on sustainable consumption; policies will be divided in terms of their contribution to changing or enabling a change in consumer behaviour. They will be grouped along three dimensions: raising consumer awareness, making sustainable consumption easy, and greening the markets. The distinctions between the dimensions highlight the fact that consumption needs to be understood as a process: it runs all the way from planning and purchase to usage and, finally, disposal.

For example, *"Raising consumer awareness"* is closely associated with the planning phase of the consumption process, while *"making sustainable consumption easy"* and the *"greening of markets"* are more closely linked with the purchase phase. Therefore, by grouping these three dimensions separately, distinctions between the planning and purchasing phases in the consumption process may be better highlighted.

Evidently, raising consumer awareness is an important factor in changing behaviour. Awareness raising instruments are, however, limited. They depend on the consumer reacting voluntarily, sometimes without the necessary infrastructure or without help in overcoming barriers to changed behaviour.

It should also be acknowledged that consumers may be willing, but unable to act in a sustainable manner. If more sustainable products are not easily available, are hard to know about or are hard to understand, or if they are prohibitively expensive, the greener purchasing decision may not occur regardless of the awareness and goodwill of the consumer. In fact, the mere perception that one is unable to adapt to certain behaviour may be sufficient to prevent consumers from taking action. Therefore, consumer behaviour needs to be taken from the level of awareness to that of action. The "value action gap" needs to be filled.

The *"greening of markets"* is the third dimension in the analysis. It can be achieved in different ways in terms of "market penetration" and "environmental performance", namely by *improving* the environmental *performance* of products, by *phasing out* or even prohibiting products with bad environmental performance, and by *increasing the market share* of environmentally benign products.

These three dimensions complement each other, and environmental policy instruments may address several of them at the same time.

Practical insights and policy recommendations

Next, the identified, latest policy instruments on sustainable consumption will be analyzed through the three dimensions of the analytical framework. Particular attention is made to the most pertinent instruments through case studies, which will cover, for instance, information campaigns (e.g. UK's "We're In This Together" and the Danish "One Tonne Less"), information tools (e.g. TopTen internet platform), and economic instruments (e.g. Dutch tax advantages for sustainable investments). The analysis will reveal insights on, for example the role of *collective action, the adaptability of instruments* as well as the need for creating *solid, consumption-focused evidence base*.

Four layers of recommendations are foreseen: the policy foundation, the policy approach, the policy instruments and the policy documentation. In terms of the *policy foundation*, any policy promoting sustainable consumption needs to be properly founded by explicitly acknowledging household consumption as a policy domain in its own right. Building upon that, the *policy approach* taken should enable policy makers to, for example, take flexible roles, integrate relevant stakeholders in an appropriate way, and establish an institutional framework that supports effective policy implementation. Our findings call for *instruments* that are adaptable to changing circumstances, and that address consumption not only as an individual (buying) behaviour, but rather as a social process. The instruments should take both the environmental *and* social requirements into account. On the documentation layer, SC policies will benefit from being monitored. This will enable a sound assessment and a purposeful re-design of the policy. Finally, one should note that, what happens on one layer may have repercussions on the other layers. Monitoring might induce a change in the design of policy instruments, new evidence on the nature of consumption might call for other stakeholders to be taken on board, the more careful consideration of social issues might lead to a shift of emphasis among consumption domains.

14.3 The Implementation of Climate Change related policies at two European Union countries: A comparative analysis between Denmark and Italy

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The objective of this article is to develop a comparative analysis of the implementation of climate change related policies – focusing on renewable energy generation – by two European Union members: Denmark and Italy. Under the European Union energy policy, the cases provide an interesting sample: a developed country more pro-active in environmental international negotiations (Denmark) and a more conservative developed country (Italy).

Through an empirical research, the article develops the two cases to understand the achievements and obstacles to implement mitigation policies at the national level. What lessons for policy makers at national level can be drawn from the Danish and Italian experiences of respond to climate change? And how have both countries being engaged and reacting to the European Union energy targets? Barriers and promising approaches are identified, based on their experience.

Currently, the two major challenges related to the use of energy are the emission of greenhouse gases – likely leading to climate change – and the security of supply. When speaking of security of supply, a differentiation is made between the necessary production and transmission capacity to cover demand at any time (power supply) and the availability of resources to cover this demand (fuel supply/import dependence). Nowadays the development of renewable energy sources is strategic and it can help to reduce the emission of greenhouse gases and to reduce import dependence.

Energy efficiency is a key element for a more sustainable future. The promotion of an increased use of renewable energy sources contributes to security of supply, mitigation of climate change and environmental protection. In European energy sectors there are an increasing attention for renewable energy sources and more efficient energy generation and distribution. The advantages of promoting renewable energy is recognized by the EU in view of security of supply and climate change challenges. It is also stressed that renewable energy contributes to improved air quality, create new business, employment and rural development. Differences in national conditions imply that the implementation of EU policies in Member States can have many variations though.

In order to initiate a study for better understand energy policy development in the European Union, two State Members were studied empirically: Denmark and Italy. The case study method is based on the understanding of how and why things happen in certain socio-economic and political context. Initially, information was collected from reports, Internet sites and academic and newspaper articles, followed by the gathering of documents during the visits to the two countries. Moreover, a series of semi-structure interviews in the two regions were carried out with government officials, members of civil society, specialists, academics and firm managers during the period between August 2008 and January 2009. Follow-up phone interviews and email exchanges were performed for information clarifications. The main points of the cases are presented below.

Denmark is a net exporter of energy meaning that 36.8% of his energy production is exported; on the contrary Italy imports 86% of his gross Energy consumption. In 2005 the share of renewable consumption to gross final energy consumption was of 5.2% for Italy and 17% for Denmark, moreover differently from Italy, Denmark has developed a specific renewable energy technology and almost the entire all he electricity from renewables is produced from wind. Even though Denmark has a good availability of non-renewable energy in Denmark (342 barrel per day in Denmark compared to 120 in Italy in 2005) Danish offshore wind capacity remains the highest per capita in Europe (400 MW in total in 2006) and the government aim at reaching 50% of the energy production from wind in 2025.

Danish wind energy model integrated renewables into the social landscape. Unlike Italy, where the production and consumption aspects of energy are segregated and considered as ruining the urban and rural landscape, energy production in Denmark is predominately decentralized and close to the end user.

Considering a political point of view Denmark has adopted a long term strategy. After more than 30 years of research and development wind energy has become reliable source of energy and a business opportunity. In fact thanks to the high development in this field, Denmark is the unchallenged world leader in terms of wind technology, exporting 4.7 billion euros in energy technology and equipment in 2007.

Behind the Danish wind energy model, we can see a strong and consistent political leadership that do not change unexpectedly over time, cultural acceptance, and bottom-up technical development each had a role to play. An important role has played a strong feed-in tariff and subsidies that has been repaid through a high taxation. Moreover the model of R&D funded through taxes has been demonstrated to be effective at providing financial support for public research, while spreading the costs of that research among all electricity customers.

On the contrary, Italy despite a large solar and wind energy availability has seen political changes and ambiguities in the current policy design. In this scenario no long term plans have been respected. In particular a consistent political view both on the R&D of renewable energy technologies and business development has not been applied. Besides, a slow bureaucracy and administrative constraints such as complex authorization procedures at local level has slowed down business development in this field.

The two cases in this article can help us to understand the dynamics and challenges of implementation of climate related policies in two countries under the umbrella of the European Union. Today's global environmental problems, such as climate change, need different approaches to policymaking and implementation. Many environmental problems are complex and need complex solutions, such as the case of climate change. National governments have different features and stakeholders, leading to diverse policy responses and solutions.

Finally, the article discusses the energy policies trajectories from Denmark and Italy and how both countries engaged in the climate change international debate and how they reacted to the European Union energy targets. Moreover, Danish and Italian best practices are pointed out and analyzed under the European context.

14.4 Government Policies for Promoting Eco-Innovation: A Survey of 10 OECD Countries

Tomoo Machiba, OECD

Text Not Available.

15.1 *Subjective and Objective Maps - the Relation Between Appropriation of Space and Consumption Infrastructure*

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It is largely accepted that consumption practices should be seen as an interplay between structural conditions and individual and social aspects. But still very little is known about how this interaction influences the daily organisation of consumption on an individual level. Consumption is on the one hand part of a system of daily routines, habits and rituals that, on the whole, serves as a relatively well-functioning response mechanism to individual, social and societal demands, assuring continuity as well as identity. On the other hand everyday routines are embedded in a surrounding context including infrastructure, supply with certain goods, access to support organisations and social networks. Life events such as the birth of a child or relocation challenge everyday routines, requiring adaptation to a new situation and new demands. Individuals that recently moved to another city are confronted with a new surrounding which has to be appropriated it in a way that suits their everyday needs. But also parents having their first child might experience new needs concerning the infrastructural possibilities in their surrounding.

The project “Life events as windows of opportunity for change towards sustainable consumption patterns” is addressing individuals that recently got their first child or moved to Berlin with a sustainable consumption campaign. The evaluation of the campaign considers both, the ‘objective’ surrounding of the participants in terms of available infrastructure for sustainable consumption and the ‘subjective’ surrounding investigating how individuals are appropriating their surrounding and incorporate it in the organisation of their daily life.

This presentation will concentrate on perception and appropriation of space by individuals that just moved to Berlin.

The process of adaptation is investigated through problem-centred interviews revealing narratives about the life event itself as well as daily consumption in the fields of energy, nutrition and mobility. The presented results will focus on processes of familiarization within the altered situation and the identification of different types of appropriation of space. Besides developing models of how altered life situations and infrastructures interact, this study attempts to discover starting points for interventions promoting more sustainable consumption.

The research to be presented is part of the “Life events as windows of opportunity for change towards sustainable consumption patterns” project, which is funded by the Social-ecological Research Program of the German Federal Ministry of Education and Research.

15.2 *Translating Consumption: the process of constructing demand for products in a consumer electronics firm*

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The onus for altering our lifestyles and reducing consumption is often seen as the responsibility of the individual consumer. Many retailers for example constantly suggest that they are simply responding to consumer demand implying that it is the consumer who is responsible for over-consumption. However as numerous commentaries attest, the phenomenon known as consumer demand is not shaped in a vacuum, rather it is shown to be constructed by numerous actors in the value chain. This study takes as its starting point the notion that demand co-evolves through the actions of both producers and consumers and that only through understanding the relationship between different actors in the value chain can we move towards more sustainable patterns of consumption. Through qualitative interviews with employees and customers of a hi-tech firm this project explores how on the one hand business constructs demand by 'enrolling' consumers and the environment into its product design and marketing, and on the other how consumers appropriate products into their everyday lives and how the different socio-technical worlds within which they are situated. As well as outlining a framework for analysis based upon Actor Network Theory this paper reports on preliminary findings from empirical fieldwork conducted so far.

15.3 Tendencies of Ethical Traceability – Cases From Organic, Artisan and Conventional Bacon Supply Chains

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This paper presents the analysis and findings of research of communication systems in the pig-pork-bacon supply chains. The focus is on ethical concerns, sustainability and traceability systems. While still increasing, pig production in Denmark has consolidated in recent years, although environmental regulations limit farm size. More than 95% of pig production is slaughtered through two producer-owned co-operatives, with the largest, Danish Crown, accounting for 90% of the slaughter (DS, 2005). A traceability system has been introduced in the pig-pork sector, and the main objective of this system is to be able to trace and isolate all potentially affected hogs in the event of a disease outbreak. The traceability system is reactive in nature and is not intended to convey information proactively to end consumers on safety, production practices or the quality of the final product. It is possible to trace each carcass from the cooling room back to the farm. Once the carcass is cut up, however, final cuts cannot be traced back to the farm of origin. In this paper we will provide an overview of the supply chains and their developments into present form. We also present some of the main ethical concerns in the sector. Obviously, animal welfare is a central ethical concern in the pig-pork-bacon chain, but sustainability and working conditions will also be discussed. Finally, we will discuss the implications and perspectives of the research for traceability and ethical traceability.

16.1 Comparative Life Cycle Assessment Approach for Sustainable Transport Fuel Production from Waste Cooking Oil and Rapeseed

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Environmental sustainability is only one of the many dimensions of a sustainable development that also includes social, cultural, ecological, territorial, economic, and political criteria. Although the main focus of the study is on the technical parameters of biodiesel utilization, the economic and social aspects of bioenergy systems such as changes in the agricultural land usage, regional development, food security, infrastructural requirements for biofuel distribution, cost related barriers to commercialization and more are equally important.

Turkey's greenhouse gas (GHG) emissions reached 341 million tones CO_2 equivalent in 2008, with road transportation alone contributing to over 10% of the total amount. Securing the energy needs and reducing the GHG emission generation of a country are two major components of national sustainable energy utilization. Within this frame, a life cycle assessment (LCA) has been performed using GaBi 4 LCA software to compare the environmental performance of biodiesel and conventional diesel fuel mixtures for the Istanbul City, Turkey.

Life Cycle Impact Assessment (LCIA) interpretation has been performed for the 5 and 20% blends of waste cooking oil (WCO) and rapeseed biodiesels with petroleum-based diesel and the results have been evaluated in terms of their potential environmental impacts with main focus on global warming through climate change. Eco-indicator 95 LCIA Methodology was used for the normalization and weighting of the obtained environmental impact potentials. Considering the normalized impact assessment results, the blends of WCO biodiesel have lower global warming potentials, with up to 21% reduction in B20 WCO biodiesel, compared to petroleum-based diesel, mainly due to the biogenic origin of the carbon contained within methyl esters of biodiesel. The reduction in global warming potential for B20 rapeseed biodiesel is 11% compared to petroleum-based diesel. The eutrophication potential of B20 rapeseed biodiesel is 53% higher compared to B20 WCO biodiesel and 45% higher compared to petroleum-based diesel. In addition to this, the weighted acidification potentials of the petroleum-based diesel, B20 rapeseed and B20 WCO biodiesel blends are determined as 0.101, 0.115 and 0.094 mPE respectively. Higher impact scores of the rapeseed biodiesel blends in both acidification and eutrophication categories are explained by the usage of nitrogen rich fertilizers during the cultivation step of the rapeseed plant. The weighted carcinogenic potentials of B20 rapeseed, B20 WCO and petroleum-based diesel are 0.025, 0.022 and 0.026 mPE, respectively. The carcinogenic potential is mainly associated with the combustion of fuel in the car engine and both of the biodiesel blends have been found to be applicable alternatives for decreasing the heavy metal emissions associated with diesel fuel combustion. Photochemical oxidant formation potentials of the B20 rapeseed and B20 WCO biodiesel blends are 7.5% and 18.5% lower compared to the petroleum-based diesel. The higher photochemical oxidant potential of the rapeseed biodiesel blend is explained by the hexane emission during the oil extraction step of rapeseed biodiesel life cycle. B20 WCO biodiesel blend has a lower winter smog potential (0.005 mPE) than the petroleum-based diesel (0.007 mPE) and B20 rapeseed biodiesel blend (0.006 mPE).

Considering the positive environmental performance of the WCO biodiesel in the global warming impact category along with the advantages of having lower acidification and eutrophication impacts (both below 0.005 mPE) due to lack of the cultivation, harvesting and oil extraction steps, it is concluded that the replacement of petroleum-based diesel with B20 WCO biodiesel in road transport vehicles is a viable option for combating the climate change along with an array of other environmental challenges. In addition, WCO utilization for biodiesel production is an alternative way of waste vegetable oil minimization.

On the other hand, while biodiesel made from WCO does not involve any changes in agricultural land use, it does require a well-developed infrastructure for efficient collection of waste vegetable oils from food factories, restaurants and fast food chains. Producing biodiesel from edible oil feedstocks such as rapeseed oil, however, raises the already well-known fuel vs. food dilemma and it is of utmost important to ensure that the primary role of the agricultural industry is to provide food security for the population. Efficient utilization of agricultural and industrial by-products such as straw and glycerin produced during biodiesel's life cycle is another significant step towards increasing the sustainability of the biodiesel fuels. Overall, a multi-stakeholder approach that will include the governmental policymakers, environmental institutions and organizations, community activists and biodiesel companies is needed to fully address the issue.

16.2 Sustainability LCA of Biofuels

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Picture year 2015: households, companies and other organizations all over the world turning their sewage into biofuels instead of discharging it into environment? That would solve two global problems at once: over-fertilization of waterways causing sea, lake and river deaths, and carbon dioxide emissions from fossil fuels contributing to climate change. This vision represents cradle-to-cradle approach in which nothing ever becomes waste but is endlessly recycled in different renewable, harmless forms. Maybe such an idea will not be applied globally by 2015, but it certainly seems, at least to laypeople, an ideal solution to our world's major environmental, socio-cultural and economic problems. The feasibility of turning sewage into biofuels needs to be put into perspective by comparing it to other ways of producing, consuming and recycling biofuels.

Biofuels can nowadays be refined from dozens of different plants and different kinds of waste. The most common plants for biofuel include maize, wheat, barley, oats, potatoes, soya beans, palm oil, rapeseed oil, sunflower oil, sugar beans, sugar roots, switchgrass and alga. In addition, e.g. straw, wood, woodchips, forest residue and peat may be used. Almost any kind of biodegradable waste and sludge are suitable biofuel raw materials.

The purpose of this research is to conduct a sustainability life cycle assessment (LCA) of different kinds of biofuels.

Sustainability has four dimensions: environmental, social, cultural and economic sustainability. In a sustainability life cycle assessment all four dimensions need to be evaluated. Environmental sustainability comprises biodiversity, natural resource use, and the effects of production, consumption and products on the environment. Social responsibility deals with issues such as wellbeing, employment, alienation, aging, equality, justice and participation. Cultural sustainability encompasses values, attitudes and customs. Economic sustainability reaches from global, national and regional to corporate and household economy issues.

Life cycle assessment (LCA) is usually defined as merely an environmental LCA (Guinee 2002, Hendrickson et al. 2006). This research takes a more holistic perspective on LCA, allowing it to cover all aspects of sustainability. Sustainability LCA is a systematic evaluation of the environmental, social, cultural and economic consequences of a particular product, process, or activity from cradle to grave or, ever more frequently, from cradle to cradle. LCAs need to cover the whole life cycle of biofuels, starting from raw materials, production, transportation and distribution to usage, maintenance, reuse, recycling and disposal as well as energy production and consumption during all these stages.

As yet there is no general agreement even of the criteria of environmental LCAs. For example the LCA section of the first version of the Nordic Swan Ecolabel covers only greenhouse emissions and energy use (Nordic Council of Ministers 2008). Hence, in the first part of this research generally acceptable environmental LCA criteria for biofuels will be compiled. The different corporate, political, civil and scientific actors will be interviewed to collect their views and experiences of environmental LCA criteria for biofuels. Based on this information a model of environmental LCA criteria for biofuels will be drafted.

Comparative LCA research in the area has focussed on comparing some biofuels to some fossil fuels. For example, SenterNovem (2008), an agency of the Dutch Ministry of Economic Affairs, commissioned a biofuel LCA, which compared bioethanol from wheat to gasoline and MTBE, and biodiesel from rapeseed to diesel. On the other hand, analyses of greenhouse gas emissions from biofuels have been conducted (e.g. Delucchi 2006, Farrel et al. 2006, International Energy Agency 2004). In addition, Hill et al. (2006) have made environmental, economic, and energetic cost/benefit analyses of biodiesel and ethanol biofuels.

In conclusion, partial LCAs of a number of biofuels have been carried out, particularly a variety of environmental LCAs, but also some economic cost/benefit analyses. Yet a holistic sustainability LCA comparison of biofuels made of the most common plants and wastes is still missing. This paper demonstrates the findings of the first part of this major endeavour: generally acceptable criteria for environmental LCAs of biofuels and a draft environmental LCA comparison of biofuels made of the most common plants and wastes. Some of these findings may be surprising to many researchers.

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16.3 Landfill gas utilization for energy to avoid greenhouse gas emissions

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Landfill gas (LFG) is usually suited for energy utilization. LFG utilization can substitute fossil fuels, hence, avoiding greenhouse gas (GHG) emissions. The magnitude of avoided GHG emission depends on different factors such as; amount LFG, proportion of methane in LFG, utilization techniques and the type of replaced fossil fuel. In this study, three alternative LFG utilization options are considered to estimate the avoided GHG emissions by formulating different scenarios. The magnitudes of avoided GHG emissions are estimated when utilization substitutes particular fuels as oil, coal, natural gas and recovered fuel. Additionally, the magnitudes of avoided GHG emissions are calculated when utilization substitutes average and marginal energy production.

The study shows that GHG emission estimations include many factors which can vary widely, thus, affecting the estimated results significantly. The differences between electricity and district heat markets have to be also taken into account as variables. This is because the district heat is usually used seasonally and locally whereas electricity can be used continuously via national or international grid. On the other hand, the magnitude of avoided GHG emissions depends strongly on the type of replaced fossil fuel or fuel mix. Therefore, the use of appropriate data for describing replaced fuel or fuel mix is essential in order to carry out estimation of GHG emissions correctly. It is recommended that assumptions and definitions have to be done carefully and case data have to be used specifically. However, even if estimations include many challenges, if it is carried out with good quality, it can offer useful information for decision-makers and significantly improve landfill gas utilization.

Keywords: Landfill gas, greenhouse gas, LFG utilization

16.4 *Environmental impacts from digital solutions as alternative to conventional paper solutions*

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Introduction

Digital solutions are becoming an integral part of our communication with companies, institutions and regulatory bodies. Documents which hitherto have been printed on paper and distributed by ordinary mail are now distributed in an electronic format with the possibility of reading them on-line for decades if so desired.

In a study for the Danish company e-Boks, the environmental impacts from distribution of documents by ordinary mail ("the conventional system") have been compared to those of electronic distribution of the same information.

The basic elements in the two systems are outlined in Figure 1.

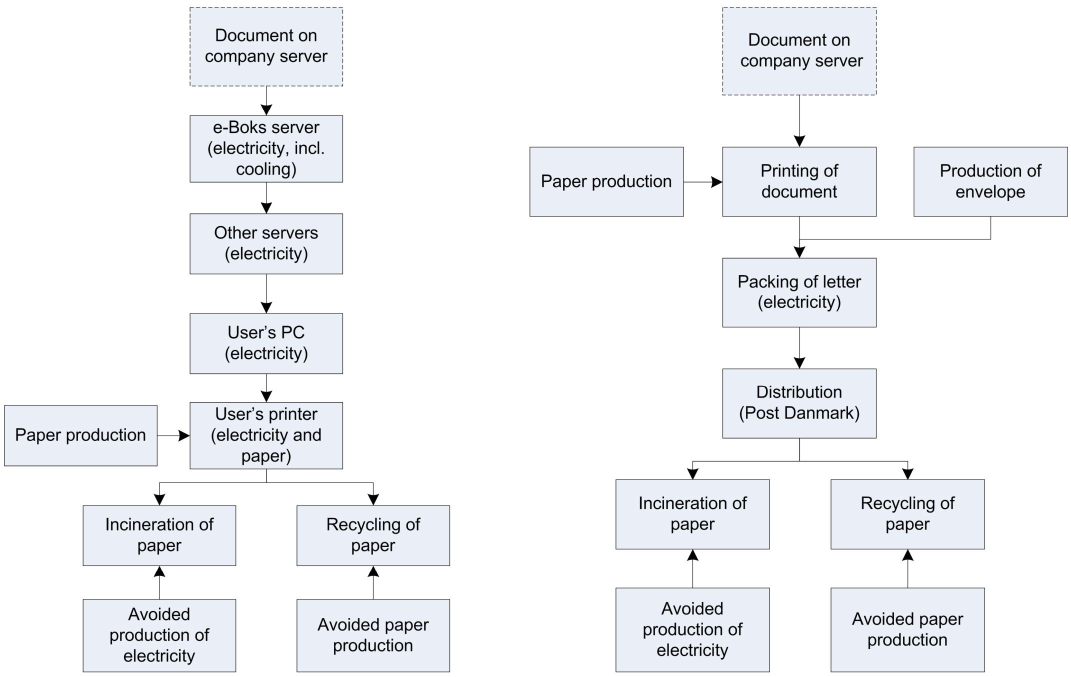

Figure 1. Basic elements of the systems for distribution of information

System boundaries

In the electronic system, e-Boks receives an electronic document from its client, e.g. a bank, and stores it on its servers. An e-mail is sent to the customer announcing that a new document is available. The customer can then log on to e-Boks and retrieve the document whenever desired. The document will remain stored on the server until the customer dies (or deletes the document), and there is thus no immediate need to make a physical copy. The environmental impacts are therefore primarily related to the consumption of electricity for storage of the documents, transmission/distribution of the documents by internet service providers and for the customers' examination of the documents. However, some users may chose to print their documents, and therefore the use of paper is also considered in the electronic system.

The study will reflect the consequences of shifting from conventional to electronic distribution, and therefore a consequential LCA approach is used. As an example the production of the PC used by e-Boks' customers is not included, the argument being that private customers will not purchase a PC with the primary purpose of being able to access e-Boks at home. In contrast to this, e-Boks needs to invest in servers in order to maintain the service. Accordingly, the environmental impacts from production of servers are included in the assessment.

For the conventional system, the consequential approach implies that the study only includes the changes caused by not sending a letter. In practice this means for example that the use of fuels for heating the post offices does not change due to a reduced amount of letters. The amount of fuels used for distribution of letters will, however, decrease. In 2008, more than 100 million documents were distributed electronically via e-Boks, and it is evident that this has decreased the demand for transport of letters by truck. Another element in the consequential approach is that the paper used in the systems at one point will be disposed of by the user. It is either incinerated with energy recovery, substituting production of electricity from coal, or recycled, substituting production of virgin paper. In both cases, the system benefits from the end-of-life treatment.

Many other issues are considered, e.g. the source of electricity used in either system and how much energy is needed for domestic use of IT equipment. The presentation will address some of the most interesting aspects.

Impact assessment

Impact assessment is primarily made using the Danish EDIP methodology, which is internationally recognised. Compared to the full methodology, some simplifications are made. Most notably, the impact categories addressed are limited to the following global and regional impacts:

- Global Warming Potential (GWP) (using the most recent update of the CML 2001 method)
- Acidification Potential (AP)
- Nutrification Potential (also called Eutrophication Potential, EP)
- Photochemical Ozone Creation Potential (POCP)
- Consumption of energy (measured in MJ), distinguishing between renewable and non-renewable energy
- Consumption of energy resources, focusing on natural gas, coal and crude oil

Local environmental impacts like human toxicity and ecotoxicity are only addressed to a minor extent as is the case for assessment of waste. The local environmental impacts are omitted because they can only be managed with a high degree of uncertainty, because of a relatively poor data quality and missing data. End-of-life (recycling and incineration) of paper is included in the model, and waste is therefore not included as an impact category.

Results

The study is expected to be concluded in May 2009, and it is thus not possible to present the results in this abstract.

27.1 Life cycle thinking in decision-making towards sustainable governance

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Abstract:
When concerned with planning and decision making, the more comprehensive and earlier it is to be considered and evaluated, the more sustainable benefit it will bring with. However, it is difficult to include every aspect into consideration. How to think in a thorough and sustainable way couldn't be more emphasized. A major challenge is to coordinate cross-sector participatory and integrate multi-level decision process, to make sure the decision has the capacity to support the long lasting development from the very beginning to the end. This paper presents a context analysis and integrated perspective using life cycle thinking way in the decision-making process based on the Life Cycle Thinking Model in Policy-making (LCTMP) it is established. Through covering a policy's life time into consideration, including target setting, current state analysis, distance analysis, proposals formation, alternatives comparison, multi-stakeholder participating, consensus building, policy formation, policy taken into force, policy modified, sustainable governance, etc, it came to the conclusion that it is efficient to use the life cycle thinking way to conduct a more rational, transparent, multi-level stakeholder involved, sustainable decision making from its cradle to grave, from its upstream to downstream, from macro-level to micro-level, so as to obtain a combined consensus and strengthened governance capacity.

Key words: life cycle thinking, decision making, sustainable governance

27.2 Input-Output Analysis and Environmental Management Systems

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In this paper we discuss how Input-Output based Life Cycle Assessment (IO-LCA) can be used in relation to environmental management systems. The ongoing work with implementing an environmental management scheme at Aalborg University forms the basis for the discussion. The use of IO-LCA can potentially be a substantial tool for the process of environmental assessment in relation to environmental management systems, supplementing more traditional methods for scoping and prioritising based on measurement of physical entities, e.g. actual measurement of material and energy flows.

A traditional LCA, also called process LCA, takes into account the emissions from all stages from cradle to grave. When a product or a service is used by a process, all upstream processes and the associated emissions are also included. The processes in a product system are linked via physical relationships/engineering knowledge and information on market mechanisms. Exactly the same principle is used in IO-LCA, but here the processes are linked via information on economic transactions. Information on economic transactions is obtained from statistical agencies, and the basis for an IO-table is a total account of a nation's economy (supply-use tables) and a total inventory of a nation's emissions (NAMEA). In principle, the only difference between process LCA and IO-LCA is the way data are collected and linked. Once the data is structured in a common LCA data format, there are no differences in the calculations required to carry out an LCA for the two types of LCA.

An IO-LCA is characterised by being based on the total economy and emissions, thus it is related to a very high degree of completeness. A weakness of IO-LCA is that the level of detail is typically between 60 and 500 different industries and products. This is a very highly aggregated compared to process LCA where e.g. the ecoinvent database represents data collection for approximately 4000 different processes. Thus, process LCA is characterised by having the potential for being very detailed in it's modelling, but it is not related to the same completeness as IO-LCA. It is not unusual that IO-LCA shows results which are 100% higher than of process LCA.

The emissions in environmental reporting can be divided into Scope 1 (the company's own direct emissions), Scope 2 (indirect emissions related to the company's purchase of energy), and Scope 3 (all other indirect emissions related to company's remaining purchases). It is relatively easy to determine Scope 1 and Scope 2 emissions, but Scope 3 emissions are harder to inventory. But having an IO-table and a company's total purchases in monetary units sorted in accordance with the product categories in the IO-table for a specific year, it is very easy to have a complete green account representing life cycle based emissions for Scope 3 emissions.

27.3 Managing environmental impact from organisations in the service sector

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Indirect environmental impact is little supported in official standards for standardised environmental management systems (EMSs) such as ISO 14001 and EMAS. However, indirect environmental impact relates to the core activities of many organisations' core activities, especially in the service sector (including the public sector).

Earlier research in Swedish local authorities shows that although they realise the importance of managing indirect environmental impact, it is found difficult to deal with within their EMSs, and therefore sometimes neglected. What does an EMS from e.g. a local authority, a central authority or a service delivering company, say about the organisation's total environmental performance if the environmental impact from e.g. consultancy, decision-making, spatial planning or education is left out of the system?

The main purpose of this paper is to explore ways to deal with indirect environmental impact within EMSs. To achieve this, interview studies were performed in Swedish authorities, banks and insurance companies, whose core activities mainly give rise to this kind of environmental impact. This paper presents the organisations' views on indirect environmental impact, and discusses possible approaches to this issue. The results from earlier studies in local authorities show that there is a limited systems' perspective when it comes to environmental and sustainability management issues. By adopting a broader approach to these issues and also perhaps management issues in general, many of the problems experienced connected to indirect environmental impact could come closer to a solution. This paper concludes by discussing and analysing broad based process management as one way of getting this wider systems perspective: an approach that could be useful in order to support the organisations to adopt a broader systems thinking when it comes to their management systems in general and thereby also help them find ways to manage their indirect environmental impact.

28.1 Gender, lifestyles and climate change

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In sustainable consumption research and policy it has become common to view consumption as a complex process, including the stages of purchase, use and disposal. Moving beyond a narrow economic perspective, consumption is defined not only in relation to market choice, but is seen as a whole set of activities, including selection, purchase, use, maintenance, repair and disposal of any product or service. Consumption activities, like eating, heating, or bathing are closely related to the way in which people organise their everyday lives. Like other social practices, these consumption practices are more or less institutionalised collective phenomena. They are governed by habits and routines rather than by deliberate and rational choice and are embedded in a social context. The way, we consume is framed by the context of households, family and community life. Consumption practices are not gender neutral and consumption is a gendered process. Women represent the largest group of shoppers, because they make the purchasing choices of everyday life items. They are involved in the entire consumption cycle of choosing, buying, using and disposing both for themselves and for others. Consumer surveys show, that women and men have differing consumption patterns. Together with income, age and household size, gender is a determining factor for consumer behaviour. Gender disaggregated statistics on household expenditure show that women have different income allocation preferences than men. Not only in so-called developing countries, but also in European countries women allocate their financial resources more on basic essentials than men do. Women spend more than men on consumer goods, including hygiene, health and clothing. Men are more likely to eat out than women, consume more alcohol and tobacco, and spend more on transport and sport. Time budget analysis provides another source which allows to assess how the use patterns of products and services in everyday life are differing between men and women. In most European countries consumption practices related to housework, caring activities and household organisation are still more closely associated with women. Despite an increasing participation of women in the labour market and the erosion of traditional gender role models, a persisting core of housework activities related to the preparation of food, washing and cleaning which is still assigned primarily to women. Gender is also an important factor influencing environmental consciousness and behaviour and perhaps more than age, income or any other socio-economic variable. Studies and surveys in various European countries show that women are significantly more aware of environmental issues and are more health oriented than men. This tendency is reflected in women's consumption patterns. Men seem to be more technically oriented and are more risk friendly and less prevention oriented. In many cases women's attitudes and orientations are more open to sustainable consumption strategies than men. It is also argued that women are likely to have less resource intensive and more sustainable lifestyles. On the other hand, it has been stated that women as well as men aren't homogenous social groups. Consumption patterns are shaped by the interplay of gender with other socio-demographic factors, attitudes and lifestyle orientations. Thus, one might argue that gender aspects are more relevant for the consumption patterns of some social groups than of others. Taking stock of ongoing debates in gender and consumer research and on findings from own empirical surveys, we will take a closer look at two fields which are in particular relevant for climate change. Focusing on nutrition and domestic energy use, we will explore to what extent consumption patterns of women and men differ within these fields and how these differences are shaped by the interplay of gender relations, lifestyles and socio-demographic factors. We will then discuss the implications of these differing consumption patterns for energy use and carbon emissions. Against this background, we argue that a gender perspective can serve as an eye opener for social differences and provides a key to sharpen the view on everyday life. Drawing on an ongoing research project (EUPOPP) we will discuss some implications for the design and assessment of sustainable consumption strategies and instruments.

28.2 The future of European Energy Label

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1. Introduction: The success story of EU Energy Label

In the ongoing EU project BARENERGY we are focusing on the strength and relevance of various barriers for change in consumer energy behaviour and how can these barriers may be overcome by technical innovations, changes in the supply from energy producers and political measures by political authorities on local, national and European level. Lack of knowledge and information among consumers have been identified as one of the main barriers for change in energy consumption in households (Throne-Holst, Strandbakken and Stø, 2008; Lüthi et.al, 2009). We will return to the BARENERGY project below. We will here only emphasise that labels are crucial tools for energy efficient purchase behaviour, and the performance of the EU Energy Label is one of the BARENERGY topics. We will discuss the potential for change in relationship to *the situations of opportunities* (Svane, 2002). The revision of the EU energy label represents an excellent window of opportunity for all involved stakeholders.

The EU Energy Label has been a definitive success. The label is based upon the framework directive 92/75/CE and covers today most large "white" household appliances such as freezers and refrigerators; stoves and microwave ovens; washing machines, clothes dryer and dishwashers. The label is mandatory both for producers and retailers. It has to be classified by the producers and the label must be visible in shops. The products is classified from an A to G scale where A is the most energy effective.

During the last decade we have witnessed a development from G to A in most European markets, and this has been the case for all product categories. The label is well-known and also trusted among European consumers (Ipsos MORI, 2008). In the period from 1995 to 2008 technical innovations have reduced the electric consumption in Europe with 12% (37 TWh) (CECED, 2008).

At the same time we have seen various problematic aspects with the performance of the label in the market:

The label is to a large degree not found on the products in shops (ANEC, 2007)

The testing of classification is complicated and expensive. Many countries don't regularly carry out tests

In most countries there is no reaction and enforcement against this insufficient market performance

Nearly all products have reached the A classification level. For refrigerators we have seen A+ and even A++ labels.

All these factors have lead to a necessary revision of the EU energy labelling scheme, where especially the last factor above have been decisive for the revision process. When there is no difference between the classifications of products, the label doesn't function as an instrument for competition.

2. Objectives of the paper: dimensions in the recent revision of the Energy label

The EU energy label has been hit by it own success, and need a revision. There is a common understanding among all relevant stakeholders that this is necessary. There is also an agreement that the new label has to be more dynamic, in order to include later technical innovations, - without starting a new bureaucratic revision process. However, there is not an agreement about how this may be included in the scheme.

The EU Commission has for some years been working with a revision, and will very soon reach to a conclusion. It has taken time to find a political and scientific compromise among member's states and all involved stakeholders, and this may be the reasons if the current deadline of March 2008 will not be reached. However, in this open process we have been able to identify various solutions and dimensions and this brings us to the objective of this paper:

· What are the main dimensions and positions in the revision of the EU energy label, based upon the 92/75/EU directive?

· May these positions contribute to develop an energy label with high level of knowledge and trust among consumers, or is it possible that the market performance of the EU energy label may be weakened?

3. The framework for our analysis: The BARENERGY Project

The framework for our analysis is the BARENERGY project, funded by the ENERGY part of the 7FP. Based upon state of the art we have identified the following barriers for change in energy consumption among households and consumers: 1)Physical and structural barriers, 2)Political barriers, 3)Cultural-normative or social barriers, 4)Economic barriers, 5)Knowledge based barriers and 6)Individual-psychological barriers:

In our analysis we will combine an individual and institutional approach. This means that individual and household energy behaviour – and changes in this behaviour – can only be understood by integrating individual values, attitudes, norms and knowledge among individuals with studies of the context in which this behaviour takes place. That is why we have chosen countries with a substantial variation as far as energy providers are concerned.

This paper deals mainly with the relationship between the political barrier – the EU energy label – and the knowledge based barrier: consumers' knowledge, trust and use of the label as information tool for purchase behaviour. At this stage in the project our analysis will be based upon a stakeholder approach. Thus, it is the perception of individual barriers among selected stakeholders - political authorities, businesses, NGOs, science - that constitute the data for this specific paper:

· Interviews with relevant stakeholders along the value chain of household appliances, at both national and European level

· Documents and written report from the EU Commission, consumer organisations and business associations[2]

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[1] If the abstract is accepted, others partners in the BARENERGY project will be invited to be co-authors

[2] To some degree these document also presents data from consumer studies, but the BARENERGY project will address consumer values, attitudes and practises in a later stage of the project.

28.3 EcoTopTen scenarios for sustainable consumption – reduction potentials due to the use of energy efficient products

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In march 2005 the EcoTopTen campaign started with the aim to regulary deliver market surveys of the most energy efficient products for private households in Germany, including product groups like e.g. heatings, cars, household appliances, computers and TV sets. Since then market surveys for 25 product groups were published and updated regularly.

In the herewith presented study it was analysed what reduction of greenhouse gases, primary energy demand and costs households can achieve by EcoTopTen, respectively by the use of the energy efficient EcoTopTen products in different product fields relevant for private households.

In order to calculate the reduction potential five household types were defined: (1) the average household using average products; (2) the efficient household, using EcoTopTen products except for food and textiles; (3) the double efficient household, the same as (3) but using all products in an efficient way; (4) climate efficient household, the same as (3) but using smaller products (smaller car, TV set etc.); (5) the same as (4) but additionally using EcoTopTen food and textiles.

The results show that an average household with two persons is able to reduce its greenhouse gas emissions by up to 73 percent or 9,5 tons CO_2 equivalents per year only by using EcoTopTen products (efficient household). An additional 4 percent greenhouse gas emissions can be saved by changing behaviour (double efficient household). Fortunately the reductions come along with cost savings of up to 980 Euro respectively 1290 Euro per year and household.

Basing on existing surveys on environmental consciousness and environmental friendly behaviour of the German population two scenarios were developed furtheron. These scenarios show the possible future distribution of household types (1) to (5) as described above and the consequences concerning the reduction of greenhouse gas emissions. Extrapolated to all 39 million households in Germany a reduction of between 10 and 15 percent greenhouse gas emissions can be achieved. Given that still between 60 percent (scenario 1) and 41 percent (scenario 2) of households stay in the category average households and do not use energy efficient products a huge reduction potential still waits to be realised.

28.4 Succeeding in Business by Managing Consumption - a more sustainable approach to selling for manufacturers

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Background

The dominant paradigm of industrial systems the past century has been mass production. This allowed products to be designed and manufactured in great quantities at lower costs, faster and of better quality than ever before. The efficiencies of mass production paved the way to mass consumerism that has since spurred global economic wealth and improved the lives of billions of people. Today it is apparent that the effects of the current industrial systems on our natural environment and consequently our own well-being are unsustainable.

Manufacturing firms have traditionally succeeded in business by selling as much as they could produce. Designers constantly created new products, factories produced them as fast and cheap as possible and marketing encouraged demand – all contributing to ever increasing levels of natural resource consumption. It was of little concern what happened to the products once they were sold and handed over to the customer. This situation is now changing rapidly, with industry creating environmentally superior products in environmentally superior factories using environmental supply chains. However, if industrial systems are to become sustainable they also need to directly address issues of consumption. The role of design, manufacturing and service delivery may no longer be to sell 'more stuff', but to address how people's needs can be sufficiently fulfilled in a manner which is economically and environmentally sensible – 'selling less'.

This paper provides three cases of manufacturing companies that demonstrates that business can be successful by selling less. The business model of each of the companies actively attempts to reduce their customers' consumption while increasing customer satisfaction. This has proved to reduce customers' costs, increased long term relationships to customers and radically reduced the environmental effects.

- **Steelcase** is the world's largest manufacturer of office furniture. The development of their products is based on user-centred insights where work, workers and workplaces are studied intensively to create new solutions of furniture, interior architecture and technology. They no longer see it as their role to sell as many chairs and desks, but to work with their customers in finding solutions to workspaces that allow employees to work effectively and satisfactorily. This might actually mean less space and less furniture, but a better work environment and better business results for their customers.
- **Vitsœ** is a small company based in England. They manufacture a universal shelving system originally designed by Dieter Rams in 1960. The shelving system is designed with longevity in mind and is easy to construct, repair and dismantle allowing the system to be extended, rearranged and moved. All new components of the shelving system are compatible with the original system. Vitsœ discourages their customers to buy more than necessary as they can always add more components at a later stage; this is seen to result in long term commitments between customers and the company. Half of their business is from existing customers, and considering the durability and long product life, this is very high.
- **SCA Hygiene Products** is a global manufacturer of paper based hygiene products (paper towels, nappies, feminine hygiene products, etc.). They are the world leader in incontinence care. In Denmark the majority of their products for incontinence are sold to health care institutions and nursing homes. Here, in addition to their products, they offer a whole range of services from planning how to achieve improvements in incontinence care, to training and coaching health care personnel on how to best use

their products, including monitoring product consumption and intervening when deviations occur. This integrated approach to products and services allows SCA to improve the well-being for the users of incontinence products, the work conditions for health care providing personnel and the total economy for incontinence care for the health care institution.

Objectives
This paper describes each company and their value propositions and how these were developed, delivered and nurtured in cooperation with customers. This is done on the basis of a framework of product/service-system (PSS) conceptualisation that elucidates four essential perspectives of PSS:

- Value perceptions
- Product and product life
- Customers and customer activities
- Actor network

Insight into these companies' business and context is presented in order to show how new, more sustainable, business models and design methods can be developed.

Method
Case study research is chosen as the research method as it gives deep insight to the research object and its context while allowing analysis of many variable factors (Yin 1994). As the objective is to gain insight in a company's practice and context, the case studies are qualitative and explorative. All the cases derive from a PhD project on PSS development for manufacturing firms. The information for Steelcase and Vitsœ was gathered by one of the authors as a participant observer in new service development projects with the companies covering 15 months and 4 months respectively. The case on SCA was mainly established through interviews of 8 key employees and 5 customers and observations from company meetings and workshops. In all three cases multiple sources of information were used and findings were presented and discussed with the companies.

Results
The three case studies presented here provide evidence that a potentially lucrative business strategy for manufacturing firms is to not just sell as much as possible but to address the consumption of their own products and thereby ensure proper use and reduce unnecessary waste of natural resources. All the companies described manufacture fairly low-tech, uncomplicated products but even in this situation, the cases show large savings can be made for the customer by influencing his or her planning and use activities. In each case the delivery of products and services supported a clear strategy to support the customer throughout the total life cycle of the products. It would seem that this approach of production and delivery efficiency combined with consumption sufficiency could hold business potential for many other manufacturers to achieve environmentally and economically sustainable consumption and production.

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29.1 Optimizing Resource Efficiency and Carbon Intensity in the Wood Processing Sector in Austria

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Currently, economy is based on fossil and mineral resources, which end as waste or fossil CO_2 emitted into the atmosphere. The vision of a sustainable economy would need the shift to a solar based economy. Hereby the use of renewable resources for products and energy services is one of the main challenges. An efficient use of biomass is a major pillar of a sustainable resource management, a maximum of service should be provided on the way from the resource to finally CO_2 in the atmosphere.

The pulp and paper industry ("paper industry") as well as the wood processing industry are actually two major turntables in the use of biomass in a public economy, so also in Austria.

Two production lines for products of biogenic origin were investigated:

Austrian wood processing industry

Austrian pulp and paper mills

Object oriented process models describing the entire production system including the life cycle of their products have been created. Each of them consists of the single processes of the production chain, but also includes the use phase and the end of life in form of waste. The in- and outputs of the processes were combined to material and energy flow balances. Taking the carbon content of the respective flows the carbon flow balance of the total life cycle of the considered product lines will be derived. The flows are grouped in fossil and renewable carbon, to distinguish the transfer of fossil carbon into atmosphere from the renewable carbon cycle.

The model allows to change the characteristics of the single processes, the process line structure and the framework conditions in scenarios for improving the situation regarding the resource and energy efficiency.

The effects of improvements on the needed resources and on the carbon flow balances are presented and discussed. Parameters in form of a comprehensive key data for evaluating the overall performance are suggested. Problematic issues for the results like long term storage of carbon in products, export and import of products and intermediates etc. are addressed and discussed.

29.2 Options for Environmental Sustainability of the Biodiesel Industry in Thailand

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Biodiesel, an alternative diesel fuel, is made from renewable biological sources such as vegetable oils and animal fats. In Thailand, the government has promoted the use of biodiesel with the purpose to reduce the imported fuel oil, air pollution and also to reduce global warming contribution. Despite obvious benefits of this industrial development, its production process generates waste/by-product, and wastewater which could have a significant impact on the environment if they are not managed properly. This research was aimed to adopt industrial ecology measures to alleviate the environmental problems encountered in biodiesel industry in Thailand. Five biodiesel factories were selected to analyze the nature of their industrial ecosystems including clean technology options and waste exchange between biodiesel industries and other economic activities. The results showed that 1 m^3 of biodiesel production generated spent bleaching earth, glycerin and wastewater equal to 8 kg, 140 kg and 0.47 m^3, respectively. All generated waste/by-product can be reuse/recycle or utilized as raw material for other industry or agricultural sector. Such an approach can contribute in transforming the biodiesel industry into a more environmentally friendly industrial activity.

29.3 Promotion of Material Efficiency through Regional Action

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PROMOTION OF MATERIAL EFFICIENCY THROUGH REGIONAL ACTION

Introduction

The first National Waste Prevention Programme in Finland was incorporated in the National Waste Plan that was adopted by the Finnish Government on April 10th 2008. The strategic goals will be disseminated into the field through Regional Waste Plans that are expected to be finalised by 2010 through a participatory process administrated by the Regional Environment Centres. As part of this exercise a pre-feasibility study was conducted for generating ideas for promotional tools and demonstration projects for Material Efficiency (MEf) or Waste Prevention (WPr) that could be applied on the regional level by public organisations or public-private partnership arrangements.

Screening of regional policy instruments

The project identified 13 potential topics focusing on specific regional or local level policy instruments or focusing on specific material streams or sectors, or on production or consumption. After prioritisation by the Regional Centres and some modification the following topics were selected for the study in order of preference:

Top priority group:

1. Minimisation of food waste in retail shops and in consumption
2. Material efficiency in public procurement
3. Promotion of reuse, repair and leasing services by municipalities
4. Material efficiency in environmental permitting

Other potentially feasible themes:

5. Material efficiency services for industry on the regional level
6. Use of e-services in promoting material efficiency in public administration
7. Material efficiency in tourism and recreation services
8. Promotion of hazardous chemical substitution and efficient use of chemicals in industry
9. Establishment of regional eco-efficiency information centres
10. Capacity building for Ecodesign-training

For each of these topics the project screened available information on Finnish experiences – or international cases to a limited extent - relevant to the goal. Three types of promotion approaches were identified:

a) Mainstreaming of MEf promotion into public governance processes (such as permitting, public procurement etc.)

b) Launching of local or regional demonstration or pilot projects

c) Organising the dissemination of experiences from former demonstration projects into best practices or organisations.

For each topic potentially effective components for regional action plans were drafted and presented to the working groups currently preparing the Regional Waste Plans. For the top 4 themes more in-depth interviews were conducted to test some of the action ideas representing one or several of the promotion approaches. The target was to prepare pilot project ideas for each of the four themes. The following concepts were proposed for the regional actors to consider. Additional examples covering some of the other topics are also provided in the presentation.

Minimisation of food waste in retail shops and in consumption

In a previous study the quantity of food waste discarded from all retail shops in Finland was estimated to be 54000 tonnes or 4.15 tonnes per 1 M€ sales value. Of this amount about 38% was classified according to the directive 1774/2002/EC as animal by-products. In addition to this, food is wasted in private households and institutional kitchens. Several elements were proposed for an action plan to prevent food waste. Voluntary agreements could be used to encourage retail chains to set targets to minimise their "end-of-shelf-life waste" and to monitor and publish their progress in reducing their specific waste generation. A case study is presented of a model for organising the collection and distribution of **a** proportion of food products before their end of shelf-life. This model uses a mobile shop-bus to distribute food donated by food retail outlets to disadvantaged individuals or families that have registered with the deacon's office of the local diocese. The rest of the food that becomes waste could be recovered in waste-to-energy units, as indicated by on-going projects. An additional element to this proposed demonstration project is the promotion of NGO driven advisory programmes to promote sustainable shopping practices, proper storage and advice on using leftovers in the preparation of new meals in households. Voluntary environmental management systems should also incorporate waste prevention goals in the case of institutional kitchens.

Material efficiency in public procurement

An action plan for the promotion of Green Public Procurement in Finland was presented in 2008 and a Cabinet decision in principle is expected in 2009. Environmental management systems are seen as a key instrument in integrating environmental criteria in public procurement management. An internet-based service and a help desk have been proposed to assist in setting the terms of references. The special case of MEf criteria was studied in this project. The procurement of product-service systems is particularly challenging. Material efficiency can be incorporated into the decision making by promoting the use of life-cycle cost calculations and setting criteria for extended life-time, recyclability and reuse. Radical "factor 4" leaps by purchasing emerging technology could be promoted by new financing arrangements to share the risks for municipal investments.

Promotion of reuse, repair and leasing services by municipalities

Enhancing reuse and promoting repair networks in member states is required by the EU Waste Directive (2008/98/EC) article 11. This goal can be combined with the goals of combating unemployment. Social enterprises can be used as an instrument by bringing these goals together. The interaction between the municipalities, extended producer's responsibility (EPR) organisations, social enterprises and private sector professionals is the key for sustainable activities. Eco-services should be recognised in the industrial policy activities of municipalities. Employment subsidies should be tailored to improve the competitiveness of repair and share services in comparison to the purchase price of similar products.

Material efficiency in environmental permitting

The project analysed the potential of environmental permitting procedures to incorporate material efficiency targets. The proposed approach is to develop a best available techniques (BAT) national reference document (BREF) describing the BAT level for a material management system geared to prevent waste. A analogue to such a guideline is the recently published EU level BREF and the national BREF application for energy efficiency. The MEf-BREF document would present mainly horizontal techniques for improving material efficiency in industry and in material intensive services.

29.4 Development of Material Flow Account and Evaluation of the Regional Eco-Efficiency in Shiga Prefecture, Japan

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Material flow account is useful for examining the interaction between economic activities and environment in the specific region, and the policies and measures for regional sustainability.

The purposes of this paper is to construct a regional material flow accounts, understand structural changes from 1995 to 2000 and apply this accounts to the analysis of impacts of industrial, economic and environmental policies for local environment in Shiga Prefecture, Japan, where there is the Japan's largest lake and ecological sustainability has crucial since industrialization, development of nature and extraction of resources began in 1960s in this region.

Material flow account system that we constructed consists of more than 180 industrial sectors, approx. 30 industrial waste treatment sectors, one municipal solid waste treatment sector and one sewerage disposal sector, and each sector has its account of input and output of goods and the discharge of wastes, CO2, and water pollution loads. This account system helps us finding characteristics of local economic-environmental problems and solutions to them.

The authors evaluated structural changes of industry and economy of Shiga Prefecture from 1995 to 2000 applying Eco-Efficiency.

The main result is that Eco-Efficiency (defined as total material input required to produce one unit of GDP) of whole economy in this region was improved by 27% and that of manufacturing industry was improved by 16%, while the economy has been shifted to service industries over time. Finally, it was showed that regional sustainability increased and industry improved its material use in the period.

29.5 A common ecosystemic currency for assessing regional tradeoffs in ecosystem services

Martin Köchy, Vegetation Ecology and Nature Conservation, Universität Potsdam - University of Potsdam, Potsdam, Germany

For a long time humans have relied on the free services of ecosystems for their food, clothing, and housing. Unrestricted use of ecosystem services (ESS), however, is not sustainable. This has led to regulations that limit the use of ESS. Most regulations are directed at industrial users because the use of free resources and services is an economical advantage that leads to overexploitation of these services in typically short-sighted economic competition. As a consequence, there have been attempts to put a monetary value on ESS. Setting a price is difficult because ecosystems are multifunctional, because their function does not scale linearly with area, and because the economic value of their services depends on their regional context. To address these issues, we propose a framework based on three premises. 1. The ESS value must be solely defined by ecological parameters to be globally applicable and independent from economic and political considerations. 2. The ESS value must be simple enough to be determined within the planning time of human impacts. 3. It must be applicable to all ecosystems. Therefore, I suggest to define the ecosystemic value as the product of four core ecosystem properties: biomass, productivity, species diversity, and structure (ratio of productivity to biomass). These properties represent singly or in combination the provision of fiber, food, animal feed, regulation services, and aesthetic values. Each property can be determined easily at the local scale for detailed planning or estimated by remote sensing and expert knowledge at the regional scale for landscape assessments. As a concession to practicability, the four core properties refer to the aboveground parts of vascular plants. For the assessment of the ecosystemic value of an area comprising several ecosystems, one would sum their individual values. Effects of spatial isolation, species migration, disturbances, and environment can be included in the value by considering their effects on the four core properties. In my contribution I will present the sensitivity of the indicator to changes in eutrophication, climate, urbanization, and land use.

39 Blueprint on SCP

Arnold Tukker, Innovation and Environment, TNO, Delft, Netherlands

26 May 2009, the largest environmental NGO in Europe, the European Environmental Bureau (EEB), presented a Blueprint on Sustainable Consumption & Production, The Blueprint was edited by Doreen Fedrigo (EEB) & Arnold Tukker (TNO), see http://www.eeb.org/publication/2009/0905_SCPBlueprint_FINAL.pdf The Blueprint was written with support of various scientists earlier engaged in the SCORE! network, and also lend a lot of inspiration from the SCORE! document a 'Framework for Action for SCP'.

The Blueprint aims to provide a comprehensive, coherent and realistic strategy plan for realizing SCP in Europe. It provides both support to and contrasts with the most important international policy approaches on SCP, as reflected in the EU's SCP/CIP action plan and the UN's Ten Year Framework of Programs on SCP.

The workshop centres around the following questions:

What are the problems of current SCP policy settings?

Many NGOs and sustainability scientists find progress in the SCP dossier slow. Yet, simple calls for stronger measures by NGOs and scientists have little value since too often policy entrepreneurs seeking the implementation of effective measure face fundamental problems such as a lack of support, legitimacy etc. What are such key blocking factors for progress?

What strategies need to be in place for realizing successful SCP policy settings?

The Blueprint suggests some strategies of fostering momentum and legitimacy for more far-reaching change, such as niche experiments, enlarging the evidence base for change, and deliberative activities. Are these the right ones? Can these be effective? What other strategies can be thought of?

How can the scientific community best help in this and how should it be organized for this?

Workshop program:

Presentation of the Blueprint on SCP, dr. Arnold Tukker, TNO

Reaction of a panel on the 3 key questions

Dr. Theo de Bruijn, TU Twente/co-ordinator GIN network, Netherlands

Philip Vergragt, initiator SCP America network, US (invited)

Eivind Sto, SIFO, Norway (SCORE co-ordination team member)

Irmgard Schultz, ISOE, Germany (reviewer, Blueprint)

Discussion with the audience. Note: in case of a high number of attendees discussion will be held in break-out groups with plenary feedback.

40.1 A Quality Strategy for Sustainable Development?

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A fundamental challenge concerning sustainable development (SD), is how to create the basis for a world that can support 9-10 billion inhabitants that are pursuing the western life stile based on a nearly insatiable consumption of material goods. The IPAT equation, generally credited to Erhlich and Holdren (1971), says that the environmental impact (I) is a function of the population size (P), the affluence level (A) and the technology (T).

Due to ethical reasons, it is difficult to address the P factor directly, but assumingly population growth will be stabilized through increased affluence level at some point. Proponents of a sufficiency strategy for SD suggest addressing the affluence level (A), by reducing the consumption in the rich countries, and obtain higher life quality by other means than material goods. Finally, an efficiency strategy implies addressing the T, by reducing the environmental impacts per unit of product that is produced and consumed.

While examining the potential in efficiency strategy, the present paper propose that it is relevant to distinguish between a strategy which address 'technological' improvements as described above, and a strategy that promote 'labour intensive' production and consumption.

Existing studies have shown that labour intensive products, such as services and products with high service content, represent a relatively small environmental burden, because human labour comes with no or little environmental impact, and because they bind a scarce production and consumption factor, namely human labour or time. This is also referred to as the time rebound effect (2008). One example of products with a higher service content could be quality products which in many cases has involved more design, more knowledge, more attention to detail and other factors that often involve more labour. This strategy has an additional advantage as it binds another scarce production and consumption factor, namely money, as quality products typically are more expensive. This is referred to as the money rebound effect, and suggests that it is highly relevant to measure environmental burdens per product 'value' instead of merely per 'unit' (Weidema 2008, Thiesen et al. 2008).

Studies exist that estimates the environmental burdens as a function of increasing income level based on IO LCA e.g. Thiesen et al. (2008). But as the product types are highly aggregated, it is not possible to e.g. distinguish between different types of food or wine – nor is it possible to distinguish between a cheap wine and an expensive wine. Hence, it is indirectly assumed that the environmental burden is the same per Euro of product for expensive and cheap version of the same product. Our assumption is that this provides misleading results, as it suggests a linear relationship between income (or spending) and the environmental burden. It also hides the potentials in a quality strategy for SD, where we buy less - but better altogether.

Why not buy 'less and better' meat and wine, or simply just buy 'better' food products, as long as it is expensive enough and represent a significant negative money and time rebound effect that will reduce the overall consumption. We acknowledge the ethical and practical limitations of this strategy in relation to low-income groups especially in developing countries.

The hypothesis 'that quality products represent a feasible strategy for SD', is examined through a case study of different types of popular food products, where it is possible to clearly distinguish between a discount and a quality version. The case study is based on a qualitative assessment of the environmental sustainability of quality variants of wine, beer, water, cheese, meat, seafood, coffee, and bread – where we include considerations of time and money rebound effects. From the same perspective the article also includes more general discussion about organic versus conventional food, local versus global food, fast versus slow food, and home-delivery versus traditional shopping. Besides food products, there are other product categories such as transport, housing, textiles etc, which could be interesting to analyse, but this has been considered out the scope of the present article. Hence, besides a few references to other products categories, the present article will mainly address food products.

It is obvious that there are limitations to a quality strategy for SD, the purpose of this article is to identify cases within the scope of food products, that both support and contradict the hypotheses – and to discuss the potentials and limitations of such a strategy in relation to different types of food products, but also in relation to how it could be used in a governance perspective.

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40.2 Food choice and consumer behaviour – Achieving sustainability by preventing childhood obesity

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Its worldwide soaring rates and its serious social and economic consequences shoved the obesity epidemic into the centre of many countries' attention. Increasingly, curtailing and preventing obesity already at child age has been recognized as a goal of a sustainable society. Lately, many countries such as Germany, Ireland, and Switzerland as well as the EU have integrated levels of obesity in their respective sustainability strategies. To date, most European countries and also countries worldwide, e.g., US, Canada, and Australia have implemented national action plans to fight the rise of obesity (WHO 2008).Since, the probability is high for obese children to become obese adults, it is high time to think about effective strategies.

According to the 1998 Human Development Report (UNDP 1998), consumption that enhances human development must be *shared*, *strengthening*, *socially responsible*, and *sustainable*. The ongoing obesity pandemic meets none of these criteria. Rather, it seriously affects the social, cultural, and economic sustainability of societies (Reisch 2003).

Social sustainability is jeopardized as far as social cohesion, equity, and fairness erode due to the consequences of obesity. In general, overweight and obese individuals are associated with debilitating health, reduced mobility, poorer employments, premature mortality and higher living expenses and thus, an overall poorer quality of life (Government Office for Science 2007).

Obesity affects *cultural sustainability* in particular when it comes to food cultures. With the rise of the McDonaldization of consumption, fast food and ready meals have started to dominate food cultures worldwide. These have been found to be related to obesity (Robinson et al. 2005). An ecologically unsustainable food supply is coming along with satisfying these food cultures' demands (WHO 2008).

Concerning *economic sustainability*, obesity's consequences for health care systems and labour markets are insurmountable. National health systems – chronically underfunded anyway – suffer from obesity's many co-morbidities. Moreover, labour market statistics show that obese people have a lower employment rate due to health consequences or other reasons such as workplace discrimination (McCormick and Stone 2007).

Basically, each individual is free to choose her preferred lifestyle, food intake, and level of physical activity - however detrimental these might be. Yet, unsustainable lifestyles become an issue for politics when the external effects of private consumption are reflected in social costs and/or when the life chances of future generations are at stake. Health and consumer policy have together started to employ the whole arsenal of instruments (information, education, incentives, regulation, creation of supportive environments) to go about this problem. Still, there is no downward trend identifiable, yet. What has become clear is that to prevent obesity needs the concerted action of all actors including food industry, retailers, the media, and marketers. The purpose of this paper is to outline and evaluate the options of different market and governmental actors to curb childhood obesity.

The European Commission notes that parents having the main responsibility for their children should be able to make informed choices and transfer their knowledge to their offspring (2007). Consumer's information, education, empowerment and engagement are relevant tools in order to pursue three main strategic goals: raise awareness of the risks of obesity, reduce energy intake, and increase energy output; yet, they might not be far-reaching enough. Sometimes, it might be worth to actively steer consumption subtly – "to nudge" (Thaler and Sunstein 2008) - into healthier choices by shaping the consumption context, i.e., access and defaults settings.

Food industries' and retailers' voluntary contribution could comprise a shifting focus from short-term goals to an investment in long-term programs (Layton and Grossbart 2006). There is a large potential for improving and standardizing the existing food labelling systems in order to reduce consumers' confusion). Easing the decision process of consumers, there is a need for easy and low cost access to sustainable healthy food such as vegetables and fruits by improving the availability. Moreover, recipes could be reformulated by modifying levels of fat, sugar or salt. Another approach would be to decrease package and portion sizes (European Commission 2008).

Marketers and advertisers should be aware of the effects advertisements have on children's food preferences. There are attempts to force the industry to act accordingly by regulations, but evidence of success is weak (Lang and Rayner 2007). Thus, policy-makers seek to establish best practices to curb especially unhealthy food advertisements targeted at children. Some initiatives already exist in Europe and the US, acting as promising starting points.

To conclude, (childhood) obesity is an important issue with regard to sustainability and there are several opportunities to overcome this epidemic. Following behavioural economics and the psychology of consumer behaviour: "Making the healthy choice the simple choice" is an important driver to promote healthy nutrition, especially when it comes to children.

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40.3 Product Service Systems: Opportunities to Improve Sustainability

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1. Introduction

Manufacturing companies have to meet contradictory demands of their environment: On the one side, customers demand latest technology equipment guaranteeing a high efficiency level over its entire life span at a low price. On the other side, the growing corporate environmental consciousness demands long lasting products using fewer resources in their development phase and use phase which lend themselves easily for closed-loop-concept in their end of life span. In solving this dilemma the concept of product-service systems (PSS) is often suggested in the literature: Products and services are combined as inseparable package to deliver superior value to customers, enhance the competitiveness of the manufacturer and reduce environmental impacts. Although it seems that PSS generate win-win potential for all stakeholders, research providing theoretical background for these assumptions as well as empirical proof in the business-to-business area are lacking. Thus the aim of the paper is to provide an overview of the large variety of PSS concepts in business-to-business relationships and to examine their effects on the three pillars of sustainability – ecological, economical and social dimension. Therefore a set of hypotheses on the effects of PSS derived by institutional economics and the resourced-based view of the firm will be tested by conducting semi-structured interviews with stakeholders of selected industries (sewage treatment, chemical industry, compressor and machine tool building industry). The results to be presented show how PSS impact upon sustainability, drivers and constraints of this impact and reveal potential positive or negative side effects.

2. Types of PSS and their Effects on Sustainability

Servicizing describes a new transaction type no longer focusing on the "sale of product" but on the "sale of use", resulting in new arrangements of customer-supplier relationships. This shift of manufacturing companies from product-focused to service-focused operations has been of interest to researchers from various fields for at least a decade - inevitably resulting in a multitude of classifications coalesced under the servicizing trend. Within the research arena dedicated to sustainability issues, innovative business relations between equipment suppliers and their customers are discussed predominantly under the term "product-service systems" (Goedkoop et al. 1999). Most concepts of PSS refer to a classification into three sub-categories: product-oriented services, use-oriented services and result-oriented services. While product-oriented services comprise traditional services like maintenance, financing, and consultancy services, use-oriented services and result-oriented services are more advanced and, as such, require new business concepts. Use-oriented services, such as shared utilisation services, aim at increasing the capacity utilisation of products by bundling intangible services and physical goods. Result-oriented services imply that customers buy a result instead of a product, or the use of a product.

Whereas PSS in its original context were closely linked to the possibility of realizing positive environmental effects, the term is widely used in the literature for describing new business concepts stressing the economical benefits for customers and suppliers without a clear focus on an environmental dimension. The "Performance-based contracting" concept in the aerospace and military industry – also known as "power by the hour" in the private sector – for example pushes the high level of availability to be reached by new business concepts. Although PSS have been promoted as solution to contribute significantly to improve sustainability, the results so far are not clear in that point. While the economical potential of PSS in the capital goods industry is subject to much scientific research, empirical analysis of environmental aspects is much more limited, mostly to the chemical and the energy sector. Hardly any research has been done to analyse social sustainability aspects.

3. Research Approach

Thus far a stable and consistent PSS theory offering explanations why PSS lead to economical and ecological benefits is lacking. A theoretical framework will be proposed, providing answers if PSS can lead to improved sustainability. First approaches in this field by Toffel (2008) and Hockerts (2008) using insights from institutional economics are taken as starting point and extended by a review of the resource-based-view of the firm. Transaction Cost Theory and Property Rights Theory seem to be promising, because compared to the traditional sale of products PSS imply changes in the mode of transaction as the supplier keeps part of property rights and hence the responsibility of the good. Furthermore the stock and coordination of internal resources, such as knowledge and expertise by the supplier determines the delivered service quality. Therefore, the resourced-based view of the firm might contribute to explain why efficiency gains can be achieved through PSS. Against this background a set of working hypotheses are elaborated in the full paper. Based on those, semi-structured interviews with stakeholders from the selected industries (e.g. industry associations, labour unions, policy makers and also scientists holding expertise with PSS) will be done to explore multiple perspectives on PSS.

4. Expected Results

The aim of this research is to contribute to the already existing approaches in establishing a theoretical framework for PSS. Beyond a theoretical explanation of possible effects by these new business concepts, this work intends to extract recommendations for practical use of PSS. Through the interviews we identify a trend on how individual PSS influence social, economical and ecological sustainability. In addition, factors that can be seen as promoter or barrier for the impact – in a positive or negative sense – will be disclosed. Further research activities encompass the testing of hypotheses using case studies conducted with company representatives of each of the four industries.

Literature

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40.4 Aiming high with low carbon: Lessons to be learned from environmental friendliness in procurement and use

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In the recent years, much focus has been on the CO^2 emissions resulting from consumption. Carbon emissions related to products and services such as fuels, food and transportation as well as the use of different technologies have increasingly been addressed by the media, governments, suppliers and private citizens. Different tools for assessment and comparison of products and services, such as carbon labels and carbon offsets, have been developed. Nevertheless, climate friendly consumption is yet to rise from the margin to mainstream.

This paper contributes to the development of low carbon markets by discussing the consumption of low carbon products in the light of research results from a related area, environmentally friendly procurement and consumption. Based on a case study on the role of environmental friendliness, the paper pin points two different market dynamics and discusses the implications thereof for understanding of low carbon markets.

The case study presented in this paper is based on semi-structured interviews with procurers, professional users and end users of urinary drainage bags in Denmark. Drawing on material constructivism (Latour 1993, 1999, Callon 1998, Law and Hassard 1999, Law and Mol 2002) and studies on work practices (Star 1999, Suchman et al. 1999, Orr 1998), I analyze the role of environmental friendliness in different interrelated procurement and use situations. Special attention is paid on identification of those concerns, routines, technologies and priorities that influence the form and significance of environmental friendliness in consumption and purchasing of drainage bags. Thus, the focus of this study is predominantly on market constitutive practices on the consumption side.

The case study results imply two major dynamics in the ways environmental friendliness is related to procurement and use: discontinuation/variation and subordination. Following from the dynamic of discontinuation/variation, environmental friendliness appears to be a fragile quality. While procurement and use of urinary drainage bags happens as a result of many interlinked events and activities, such as budgeting, marketing, logistics, recommendation, needs appraisals, procurement and application, these are not necessarily based on the same premises. Also participants to these events change. Amidst these shifts in settings and participants also environmental friendliness as a product quality appears and disappears. Furthermore, environmental friendliness is enacted in different versions, for example as PVC-freeness or waste reduction, in different locations and practices – and in some situations not at all.

In terms of the dynamic of subordination, environmental friendliness appears as a secondary quality that is often delegated to aside as other qualities become more significant for choosing the product even in those practices and by those market actors who do pay attention to the natural environment. Thus, environmental friendliness is not the only or the most important quality when choosing a product. It is subordinated to other product qualities, mainly price and functionality. When environmental friendliness comes to play a significant role this happens under the condition of a price limit or when the product is bought for a specific subcategory of users. In addition, environmental friendliness is sometimes taken into account as bringing added value to an otherwise well perceived product.

How can these two dynamics help us better interfere in the development of low carbon markets? When attempting to make carbon efficiency a significant product quality, it is necessary to consider three suggestions that stem from the analysis of the case study. First, to address the end consumer is not necessarily enough when attempting to change consumption patterns to a less carbon intensive direction. Rather, one needs to acknowledge the complexity of purchasing processes which often consist of chains of related events and actors many of which might be relevant for the role that carbon efficiency acquires in the end. Second, the producer might attempt to establish carbon efficiency of the product as a product quality that attracts the coming buyer. This, however, is not in her hands – carbon efficiency might become a non-quality in the next possible occasion. Given the complexity of the process leading to a procurement decision, it might be beneficial to identify those actors and events that greatly influence and restrict other actors' decisions within the process. If, for example, a procurement officer in an organization only accepts low carbon products, the successive choice of products for those using them will be restricted by this decision. Third, the case of urinary drainage bags underlines that procurement is seldom based on comparison of products in terms of one product quality alone. Furthermore, environmental friendliness is usually not privileged over product qualities such as price and functionality. Therefore, the producers of low carbon products need to ensure that their products can be made competitive in regard to many different qualities, not only their carbon intensity.

40.5 Exploring socially responsible purchasing in Swedish organisations

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The role of businesses in contemporary society is changing. Many companies experience rapt attention to their actions from a number of stakeholders, among others customers, media, governments and investors. Even public organisations are getting under public scrutiny. Despite the growing attention to social issues, little knowledge exists regarding the incorporation of social aspects into procurement activities by both businesses and public organisations. Although much can be learned from looking at the green purchasing literature, it is a fact that many of the preconditions and practices are different in socially responsible purchasing (Carter, 2004).

There appears to be a gap between the societal desire of more socially responsible purchasing and the slow implementation and uptake of socially responsible purchasing at the aggregate level across companies and organisations. And although many companies have some kind of policy for including social aspects in dealing with suppliers, the extent of deployment and integration of these policies can differ significantly (Murray, 2003). Therefore, there is need for an in-depth investigation of available experiences from pioneer companies. The purpose of this study is to empirically examine how social issues are addressed in purchasing activities in 20 Swedish public and private organisations and what are the existing and potential drivers and barriers for socially responsible purchasing.

The study finds that in Swedish organisations, the main drivers for socially responsible purchasing include stakeholder influence and organisational values, media and NGOs attention and employees' concern. The main barriers are a lack of resources for supplier audits, difficulties to ensure that all suppliers fulfil the Code of Conduct, differences in culture and management style, low levels of social standards and high levels of corruption in some countries of supply, all of which makes assurance practices a very costly enterprise.

The general conclusion from the interviews and analysis of academic literature is that there are still very few Swedish organisations that integrate social criteria into their purchasing practices. Among these companies, absolute majority are large international companies. Also, what becomes clear is that much of the reality of socially responsible purchasing in Sweden is still risk management. The type of strategy that organisations choose to work with in socially responsible purchasing reflects the development stage an organisation is at. Often, an organisation initially employs a reactive strategy having just faced the first hang-out in media for inappropriate action in the supply chain. With time, many organisations develop a more proactive strategy by shifting towards more hands-on, pre-emptive and systematic approach. Thus, there is a large difference between the level and extent of development of socially responsible purchasing in different organisations.

There is also a big difference in the level of efforts and available for socially responsible purchasing resources between public and private organisations, with latter having typically more resources to invest in social issues, but also being much more driven by media attention, investors and public interests. There is however a large degree of divergence also among organisations in public sector in the level of their efforts. There are still very few public organisations that have included social issues in their policies and are just few organisations that have placed requirements on suppliers and checked their performance.

There seems to be a higher number of companies from private sector that develop their Code of Conduct with social aspects, include social requirements into their purchasing contracts, monitor supplier performance through evaluation of provided documentation or through audits, and that develop long-term relations with suppliers aiming at improving social standards in the entire supply chain. Among business companies, producers of consumer products seem to be under more pressure from media and consumers, than companies that supply to other businesses. Also companies that are on the stock market seem to have a drive from socially responsible investors and have therefore progressed further.

Reflecting on the difference in the scale of efforts and the progress, organisations express different needs for support tools, manuals and external support. However, the most problematic stage is when an organisation has to develop own tailor-made tools that suit the main set of organisational values and structure, the range of suppliers and types of products. Another problematic stage is the supplier audits. Organisations reveal that current tools and methods of monitoring business practices of suppliers are unsatisfactory. They are too time and resource consuming, are often in need of external verification and are of seemingly decreasing quality if conducted by auditors located in the country of supply. This indicates that perhaps a more coordinated approach of collaborative and complementary monitoring might be a way forward.

Though exploratory in nature, this study furnishes managers and public procurers with an understanding of the dimensions and drivers of socially responsible purchasing, as well as of steps for how organisations incorporate social issues into their structures, procedures and everyday practices. The study is also useful for public authorities, businesses and public sector, as well as for broader audience, including NGOs, academia and other stakeholders interested in the current situation with social issues in supply chains of Swedish organisations.

41 Making Carbon Footprints by using input-output in a hybrid LCA

Jannick Schmidt, Aalborg University, Denmark

The workshop will focus on how to carry out carbon footprint studies using a combination of process-based LCA and IO-LCA, i.e. a hybrid approach. The set-up is mainly a hands-on and workshop form, where participants solve identified challenges through workshops. A few essential lectures will be held by leading scientists within the field. In the workshops, the LCA software used is SimaPro 7. The workshop is followed by a Ph.D colloquium covering this issue and others.

Background

Carbon footprint as well as input-output LCA (IO-LCA) are fields which face significant growth the latest years. Carbon footprint is used for documenting GHG emissions related to products in a life cycle perspective, and GHG emissions related to a company's activities including upstream and possibly downstream exchanges.

The traditional approach for carbon footprinting is the so-called process-based LCA, where a number of unit processes are identified, and defined as being part of the product system. These unit processes are usually connected via physical flows (based on engineering knowledge). A major problem related to process-based LCA is the applied cut-off rule. Cut-off rules specify processes which are not included in the product system. Typically, service inputs such as business travelling, marketing, consultancy, accounting, legal assistance, education etc. are not included. Also, sometimes capital goods (buildings, machinery etc.) are not included. Despite the fact that cut-off rules exclude many potentially significant GHG emission contributors, they can seldom be consistently applied. According to the PAS2050 and the ISO 14044 cut-off criteria may be environmental significance. However, since the environmental significance is first known when the inputs of concern are inventoried, such criteria are problematic for the LCA practitioner.

To overcome the problems of cut-off rules, IO-LCA data can be used "to fill the gaps" in the process-based LCA. IO-data are based on a nation's total economic transactions combined with total emissions accounts (NAMEAs). Therefore, such data do by definition not imply any cut-off rules – all transactions and all emissions are included.

The workshop is followed by a Ph.D colloquium during which the Ph.D students present their studies, get feedback, and solve identified challenges. The student presentations will be supplemented with expert inputs and short lectures.

51.1 *Role of Retailer Companies towards Sustainable Consumption and Production: A European Map of Initiatives and Future Prospects*

Burcu Tuncer, UNEP/Wuppertal Institute Collaborating Centre on SCP, Wuppertal, Germany

Retailers have a “gatekeeper” role within many product chains connecting suppliers with consumers and vice versa. On the one hand, being in direct contact with consumers, they exert significant influence on what products consumers want to buy, and how they use and dispose them. On the other hand, they reach out to suppliers worldwide bearing the opportunity to encourage green and fair production practices.

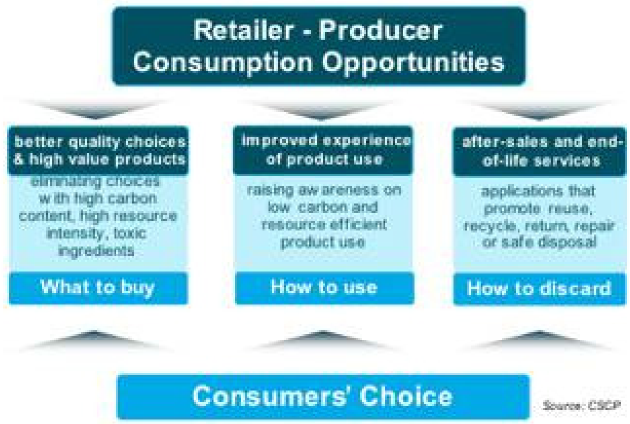


Figure 1 : Brief overview of retailers' influence on consumers' choice.

Retailers can directly influence consumer choice at the sales point, during consumers use of products and at the end of product life (see Figure 1). Working together with their producer and supplier companies, retailers can edit choices, and encourage ecologically correct and socially fair manufacturing processes. To communicate these differentiated product qualities and to well position their green and fair brands, they use a variety of marketing, advertising, and communication tactics at the sales point. In addition to this, to communicate improved experience of product use and after-sales value, they utilize other set of communication strategies from delivering information on packaging of products to forming third-party partnerships or setting up take-back systems. However, retailers' role is not limited to putting life cycle thinking into practice. Beyond this, they can and do play a role as well in encouraging sustainable ways of living as they communicate certain values and induce particular habits.

All in all, retailers' efforts towards sustainable consumption and production can span three major functions looking from a life cycle perspective: upstream efforts in relation to suppliers and producer companies, in-store operations and consumer relations. From life cycle assessment studies, it is known that priority for action for retailers are often located upstream within their supply chains, followed by downstream consumer use phase activities while in-house aspects as their direct impacts are considered to be relatively low importance (See Figure 2). Having said this, most retailers can foresee only their first tear producer companies and in-store operations as they can easily exert control and anticipate immediate value. The degree of influence retailers can exercise in their supply chains depends on the degree of vertical integration and brand ownerships. On the consumer side the motive to provide consumers with information on supply chain issues as well as environmentally friendly use and disposal may not be straightforward. Recently the strategy of choice-editing - removal of “unsustainable” products and services from the marketplace in partnership with other actors in society is often suggested as the core sustainable consumption approach for retailers. However, some retailers are reserved to limit consumer choice as they see themselves as choice providers, so choice editing may not be as easy to put into practice. Indeed these issues are rather taken up by producer or brand-owner companies.

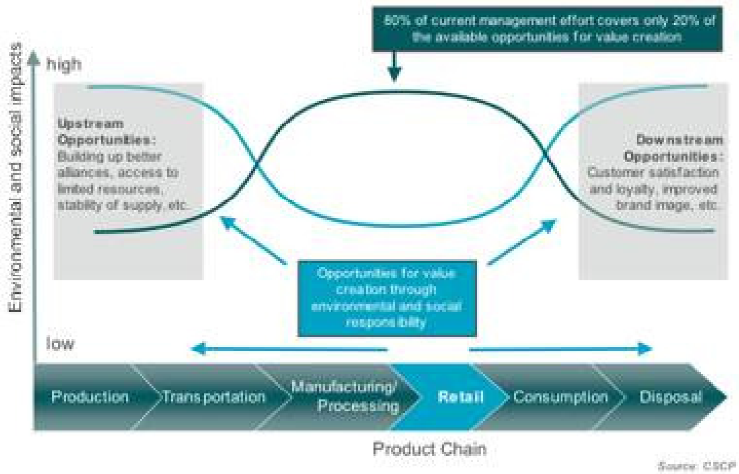
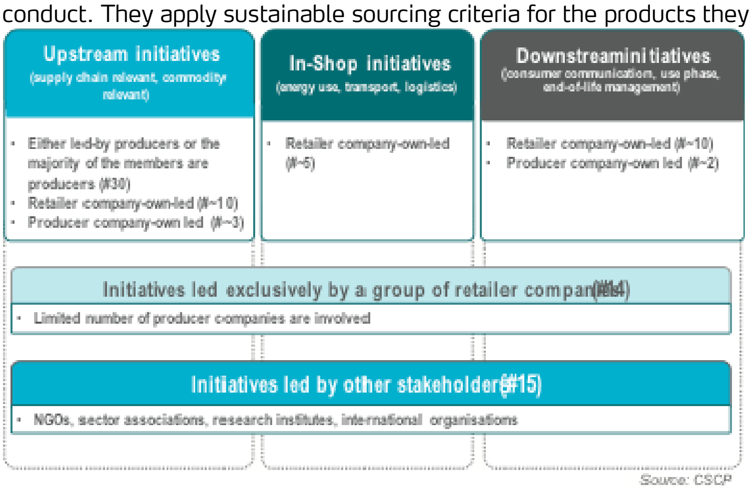


Figure 2: Upstream and downstream opportunities for retailers within the product chain.

Given this framework, the objective of this paper is threefold: *first*, the large numbers of retailer initiatives which have emerged in recent years aiming to develop life cycle management practices to achieve sustainable operations and products, have made it difficult to keep an overview about the scope, issue areas and effectiveness of these initiatives. To address this issue the first part of this paper briefly describes and classifies current European initiatives taken by retailers and companies to recognise current actions and areas for performance improvement of management strategies. *Secondly*, given this map of initiatives, the paper has the objective to reflect on the most recent initiatives such as the upcoming Retailer Forum within the EU SCP Action Plan and the retailers project group under the UNEP/SETAC Life Cycle Initiative.

Concerning the initial section of this paper, inventory of the life cycle management initiatives led solely by retailer companies, or where retailers are involved resulted in about ***90*** initiatives focusing on different product life cycle stages and different issues (See Figure 3). Initiatives at the *shop-level* are usually on environmental improvements at the site-level such as energy and water efficiency, packaging and waste reduction, efficient logistics and use of environmentally friendly building material. About half of the initiatives identified are relevant all retailers irrespective of the products they sell (crosscutting initiatives), while the other half are initiatives led by a group of food & drink retailers.

Upstream initiatives usually focus on both environmental and social issues including labour and pollution issues during extraction and production stages. In many cases these are initiatives led by producers where retailers have joined at a later stage. Most of these upstream initiatives are quite ahead in identifying main life cycle issues and developing them into responsible sourcing and/or labelling criteria (e.g. FSC, ETI, Fair Trade). Some of the retailers have integrated these criteria in their supplier code of conduct. They apply sustainable sourcing criteria for the products they buy, including products they sell to customers as well as (indirect) products they use at their stores.



The purchasing decisions of these customers, as well as how they use and dispose of goods at home, have a great impact on the environment and energy usage. Through *downstream initiatives*, retailers help their customers to make informed decisions about products and their use. Sector-level initiatives identified focus on encouraging sales of energy-efficient lighting and products with reduced carbon footprint, while company self-led initiatives focus on sales of more environmentally-friendly and ethical products.

[1] A preliminary study on what these functions might entail from sustainable consumption and production perspective is described in the Guideline Manual for Retailers Towards Sustainable Consumption and Production, "Retailers Calendar – Exploring New Horizons in 12 Steps Towards Long-Term Market Success". This study is available for download at the link: http://www.scp-centre.org/RETAILERS_ROLE_TOWARDS_SCP.1938.0.html

[2] See for example the recent publication of the WBCSD (2009) Sustainable Consumption Facts and Trends from a Business Perspective.

51.2 Communicating Environmental and Ethical Aspects at the Shop Floor Level: Examples from Nordic Retailers.

***Kirsten Schmidt*, Aalborg University**

Text Not Available.

51.3 World Café Discussion

Text Not Available.

52 From Climate Strategy to Solution Implementation

Jan Poulsen, PE North West Europe, Denmark

PE INTERNATIONAL, one of the biggest companies of sustainability experts with a broad variety of services, can cover almost every sustainability issue and combines strategic consulting and operational implementation to create a unique solution package. We provide the tools and know-how to develop more eco-efficient products, and calculate the direct consequence on the overall environmental baseline for the company.

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If you have a specific case you would like to analyse please visit our booth or ask for a GaBi 4 demo CD. Here you can meet our expects and discuss your challenges and requirements.

64 Theme Perspectives and Closing

Arnold Tukker, TNO, the Netherlands, and Stig Hirsbak, PREPARE, Denmark

Text no available

70.1 Introduction and Case 1- Sustainable Tourism in Bulgaria and Romania.

P. Murillo, UNIDO

Text Not Available.

70.2 Case 2 - CP in the metalworking industry, cookware METALAC.

B. Dunjic, UNIDO

Text Not Available.

70.3 Case 3 - BOMEX company: Competitiveness through implementation of the cleaner production technologies.

A. Kokov, UNIDO

Text Not Available.

70.4 Case 4 - Integral management of municipal solid waste in Havana, Cuba.

P. Murillo, UNIDO

Text Not Available.

5.1 The development and implementation of Photovoltaic Solar Power in Japan - A Functions of Innovation Systems analysis

Linda Kamp and Marjan Prent, TPM Faculty, Section Technology Dynamics & Sustainable Development, Delft University of Technology, Jaffalaan, Netherlands

Renewable energy technologies have to overcome considerable barriers in order to break through in an established system such as the fossil fuel system. In order to analyse the development and diffusion process of renewable energies, not only the technical and economical aspects have to be studied, but also the social system that influences the development, diffusion and implementation of renewable energy technologies. We call this social system the innovation system (IS).

In order to grasp the dynamics of innovation systems and to reach a better understanding of what really takes place inside these systems, we propose to analyse the activities that take place within the innovation system, since the process of change is the resultant of many interrelated activities. Activities in innovation systems are considered relevant when they influence the goal of the innovation system. The goal of an innovation system is to develop, apply, and diffuse new technologies. The activities that contribute to the goal of innovation systems (both positive and negative), are called 'functions of innovation systems'.

Based on several empirical studies at Utrecht University, we propose the following set of functions to be applied when mapping the key activities in innovation systems, and to describe and explain shifts in technological innovation systems.

Function 1: Entrepreneurial activities (F1)

Function 2: Knowledge development (F2)

Function 3: Knowledge diffusion (F3)

Function 4: Guidance of the search (F4)

Function 5: Market formation (F5)

Function 6: Resources Mobilisation (F6)

Function 7: Counteract resistance to change (F7)

Both the individual fulfilment of each system function and the interaction dynamics between them are of importance. Positive interactions between system functions could lead to a reinforcing dynamics within the TIS, setting off *virtuous cycles* that lead to the diffusion of a new technology. Thus, the fulfilment of the individual functions is strengthened through interaction between them.

Vicious cycles are also possible, where a negative function fulfilment leads to reduced activities in relation to other system functions, thereby slowing down or even stopping the progress.

We can learn a lot from 'best practices', analyses of the successful implementation of certain new technologies in certain countries. This paper analyzes the successful development and implementation of PV technology (photovoltaic solar power) in Japan in the period 2000-2008. The fact that the Functions of Innovation Systems framework has not been applied to a Japanese case study before makes this research highly original. Furthermore, successful developments in non-Western countries can yield original insights.

The thorough qualitative case study research was performed by a Japanese speaking Dutch researcher in Japan. Our analysis shows that especially the functions 'market formation' and 'counteracting resistance to change' were fulfilled very well in Japan and acted as the starting point of self-reinforcing virtuous cycles. During the period 1993-2005, both development and diffusion of PV in Japan went very well. Several large companies, facilitated by R&D subsidies, carried out R&D activities (F2), which also lead to high knowledge dissemination (F3). Also market growth was strong (F5), due to lobby activities (F7) of the PV branch organisation that facilitated and promoted the continuation of market support mechanisms by the government (F6). The growing market in turn attracted new entrepreneurs (F1) which supported the lobby activities (F7).

Although the Japanese market is still growing, the growth rate is declining since 2005. Several Japanese actors see this as a bad sign. Several manufacturers redirected their efforts towards foreign markets and are therefore not inclined to lobby for new specific Japanese market support mechanisms (-F7). It is not clear yet whether these developments reveal a temporary dip or the start of a structural decline in annually installed PV capacity.

In Japan the entrepreneurs were very successful in their lobby activities for R&D and market support mechanisms. This set off a strong virtuous cycle between entrepreneurial activities, lobbying activities, resource mobilisation leading to both knowledge development and market formation, which in turn led to increased entrepreneurial activities.

In this paper more of these kinds of functional patterns will be identified and analysed. Based on the analysis, we formulate recommendations for western policy makers and technology developers.

5.2 Stimulating sustainable energy innovation through policy learning and joint action

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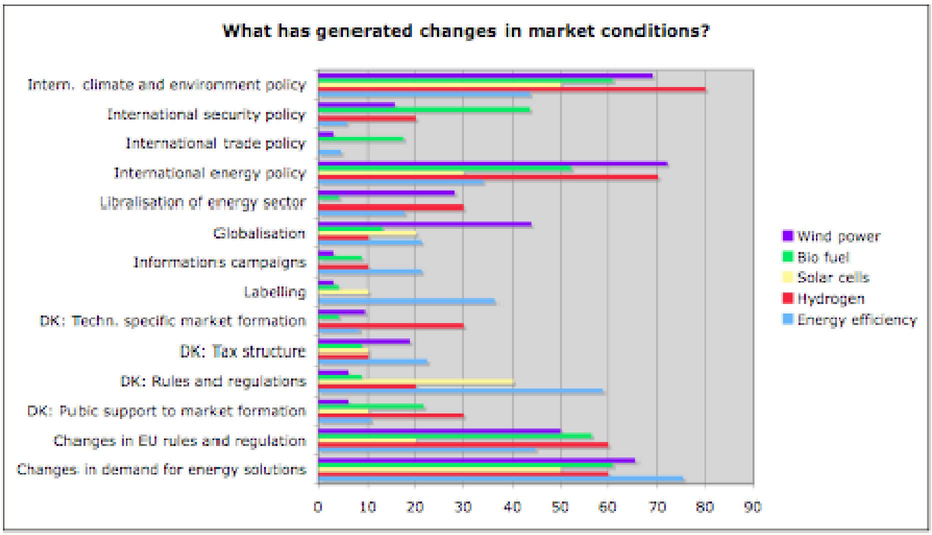
Abstract

Related to the climate crises debate, innovation and technology development in the energy area are currently among the most frequently discussed subjects within policy, media and general business development discussions. Based on an ongoing comparative analysis of five technology areas: bio fuels, hydrogen technology, wind energy, solar cells and energy-efficient end-use technologies this paper presents a policy learning perspective on the development of renewable energy technologies in Denmark. Although the empirical basis is the specific Danish context, lessons learnt are relevant in a broader policy context as well.

The market conditions within the latest years have improved in relation to the possibilities for implementing and testing new energy technologies. Figure 1 gives an overview of what factors the Danish actors see as key drivers for such ongoing changes within the various technology areas. It is interesting to notice that there are both similarities and differences between the five technology areas. Among most of the respondents, independent of technology area, the international policy scene in the form of EU regulations and international energy, climate and environment policies is considered as a key driver for the increasing demand for sustainable energy solutions. In addition, especially Energy efficiency and Solar cells respondents draw attention to the importance of domestic regulations (for instance in relation to construction) and energy labelling as explanations for the changing market conditions within their technology areas. Similarly, a new technology area as hydrogen sees domestic public support as important for market formation, while a more established and export oriented area as wind energy emphasizes the international policies paying relatively less attention to the national policies.

Figure 1: Factors influencing changes in the market conditions for implementing and testing new energy technologies. Technology area. %.



Based on the Energy technology survey 2007. (N=1038, more than one answer possible)

Source: Borup et al. (2007)

The energy technology areas are quite diverse in a number of innovation-relevant issues like actor set-up, institutional structure, maturity, and connections between market and non-market aspects. Despite the fact that the five technology areas are all embedded in the context of the energy sector in Denmark, there are large differences between the areas and the patterns of development. Though there also are similarities, the analysis shows that a discussion of dynamics and conditions of innovation in the energy area needs to be sensitive to the specific technology areas as well as to the market conditions.

The high degree of diversity between the different technology areas implies that an efficient innovation and energy policy has to take into account these differences. The policy has to be specific and reflect the variation in maturity. In areas like solar cells, where the market is formative, qualified demand – for instance in the form of strategic public procurement - is central for the technology to develop further. In areas like energy efficiency, where there are considerable markets within selected fields, indirect public policy support in form of for instance information campaigns may be very effective (Borup et al. 2007).

The existing use and combination of different policy instruments varies considerably between the various energy technology areas. There is a need for a higher degree of coordination between the different policy initiatives. Synergy can be obtained by a strategic combination of different instruments (market and non-market based).

Policy learning is together with technological, organisational and institutional learning an integrated part of the learning economy. It implies that policy-making itself is a process of learning and that this process more and more takes learning and competence building in many parts of the economy into account. The goals, the instruments, the models, the data, the competence of the bureaucracy, the organisations and the institutions develop over time in interaction with each other. This is done partly as a conscious, and maybe even designed, process in which policy makers, bureaucrats, experts and scholars communicate and develop values, knowledge, competence and institutions over time – *direct policy learning*. It is also done in a less conscious, learning by doing way, or even as learning by accident as when policy makers discover that environmental regulations also in some cases, unexpectedly, increase competitiveness – *indirect policy learning*. It is clear that for instance the Danish wind power policy has never been conducted within a rational choice framework. The goals, the instruments, the relevant knowledge and the institutional framework have not been stable but have co-evolved and diversified since the 1970s where the Danish wind energy 'adventure' took off. It makes more sense to describe it as a process of both direct and indirect policy learning.

In this paper innovation and policy learning processes in the different energy technology areas will be mapped, compared and analysed in order to get a better understanding of the policy impacts on the development of sustainable energy technologies.

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5.3 Low Carbon Innovation Policies: from National Competitiveness to Global Leverage

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Low Carbon Innovation Policies: from National Competitiveness to Global Leverage

Diffusion of low carbon technologies will require radical shift in innovation policies. Current national innovation strategies are not sufficient in rapid diffusion of climate technologies as they are fundamentally designed around national competitiveness priorities, not to produce global public goods.

The dominant focus of innovation policies in developed countries has been on science and technology support. While being historically successful and important from national capability development and competitiveness perspectives, these policies often fail to bring along wider market transformations. In order to fill the existing low-carbon innovation gaps, higher priority should be given to practice-oriented innovation policies. “Shortening the distances” between different actors is a prerequisite for the new generation of user-driven, open innovation systems.

This paper will explore how user-driven innovation policies could better serve low carbon innovation in a global scale. Special attention is given to the role of collaborative research and development activities between developed and developing countries, and how these collaborative strategies could be supported by new innovation policies. Developing countries require support to build effective innovation systems, not just narrow technology transfer like the Clean Development Mechanism of Kyoto Protocol.

5.4 Framing System Innovation for Policy Makers and Industry: A Challenge for Going Beyond Incremental Change.

Tomoo Machiba, OECD

Text Not Available.

6.1 The creativity gap? – bridging creativity, design and sustainable innovation

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The call for a radical transformation of global socio-technical systems to avert the worst potential impacts of climate change, global financial shocks, social inequality and resource depletion is growing louder by the day. Innovation is represented as a key mechanism for productive growth in the economy and there is an extensive body of literature addressing the interface between innovation and sustainability. Until recently, design as a creative process and business strategy has been underrepresented in the innovation literature. Design has also been underrepresented in the sustainable development and sustainable consumption and production literature. There are a number of reasons for this. Thomas suggested that political scientists, economists or environmental scientists, with little or no design expertise, dominate the research field (Thomas 2008). But it is also true that design and creativity are elusive concepts and can evade formal measurement and analysis.

The general focus in the literature on technological innovations fails to prevent a complete picture of the role of design insofar as many innovations are based on novel designs or concepts as opposed to technical novelty (Tether 2005; Whyte 2005). While the 3rd revision of the manual has extensive treatment of innovation outside of or ancillary to the development or use of technology it remains limited in scope (OECD 2005). The understanding of design is reaching beyond traditional perspectives on the design of products, services and brands towards more strategic considerations. This is also reflected in the discussion on the role of design and sustainable development. The discussions have evolved from primarily ecological concerns to integrated discussions on sustainable consumption and production, social innovation and economic development in the broadest sense.

Design has always been an inclusive process involving many specialists, communication channels and often large organisational structures. It is an increasingly fragmented and geographically diffuse activity that crosses international time zones and cultural barriers. Research on product and service development has been dominated by linear, staged and endogenous models. These models, while providing useful frameworks, are increasingly insufficient in portraying the complexity of product and service development in the context of global supply chains, distributed manufacturing, disruptive innovation and ecodesign[1]. Design often has an exogenous organisational structure, complex relationships, distributed communication channels, multiple stakeholders representing potentially higher risk.

Within these models there are a number of management frameworks and tools that are geared towards providing insights on the outcomes or analytical processes of designing in a more sustainable manner. These frameworks are often challenging for designers and design managers as they incorporate processes and technical requirement outside of traditional design expertise. These include full life cycle impact analysis, full life cycle costing, new material considerations and increased standardisation. There are a number of areas that often remain overlooked in the literature such as adaptations needed for business organisations to put this knowledge into practice and the key capacities and competencies required by designers to implement these frameworks and tools. This latter point is important because the success of any design or innovation process is dependant on the quality of the people involved.

The issue of capacities and competencies for ecodesign is increasingly important in the discussion on public policy interventions to improve the sustainability of design practice. To date the discussion on rationales for intervention in economic systems has been dominated by the market failure perspective. Recent discussions emerging from the evolutionary economics and innovation systems literature place a greater emphasis on systems failure as a rationale for intervention (Chaminade & Edquist 2007; Woolthuis et al. 2005). As identified by Smith, some of the areas of concern include failures in infrastructure provision and investment, lock-in failures and institutional failures as opposed to recreating market conditions or optimum economic efficiency (Smith 2000). Some of the key characteristics of systems failure interventions include increased collaboration and interactivity, learning and tacit knowledge, innovation capacity building, flexible and responsive policy frameworks and increased policy coherence.

This paper will seek to highlight the "creativity gap" in the discussion on sustainable innovation as a response to climate change. To do this it will discuss the issue of intervention to support ecodesign with a specific emphasis on capacity building[2], systems failure and ecodesign practice. It will focus on key but inherently difficult entry points for intervention within small to medium sized enterprises. The paper will draw on insights from the literature alongside empirical insights from a pilot programme of ecodesign intervention in. The paper will also propose a conceptual framework for interpreting capacity building for ecodesign and highlight how this framework can inform future policy interventions in the UK and Europe.

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[1] It is important to note that when the authors use the term ecodesign they include all perspectives on the role of design in sustainable development e.g. sustainable design, social design and potentially transformation design.

[2] Capacity building is an iterative process that incorporates the building of frameworks, work cultures, policies, processes and systems enabling an organisation to improve performance to achieve successful outcomes.

6.2 Making Ecodesign Simpler than Ever Before: Experiences from empirical intervention

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For the past three decades environmental awareness has developed at an increasing pace in the research community, on governmental levels and in industrial organisations. Three waves of environmental awareness have driven efforts in industry and society; each time raising the level of knowledge, activity and actual results achieved. In the meantime a steady effort from the research community has maintained focus on tools, methods and mindsets for environmental assessment and improvement, and governments internationally (not least in EU) have systematically increased environmental expectations and requirements in a series of areas.

Judging by this brief (and admittedly incomplete) history of environmental awareness over recent decades, it seems that all ingredients are in place to make major breakthroughs in the products and processes developed by companies. And it is true to say that there are many stories of companies, which are working increasingly to reduce their human impacts on the environment and nature. However, on engaging in dialogue with a range of industrial companies, few report to be ready to embrace the task of environmental improvement (ecodesign) into their product development processes, through internal communication and development channels, or through the choice of methods and processes.

Various research projects from the late 1990's focused on the mechanisms necessary to encourage the integration of environmental considerations into the product development process in organisations; some focusing on the tools necessary to achieve this, others focusing on issues of organisational change. All of these projects pointed towards a few multi-national corporations (e.g. Philips, HP, Motorola) who could clearly be seen to be first-movers in ecodesign implementation, at one end of the scale; and at the other end of the scale a large handful of small enterprises, fighting to make a good environmental idea into reality (e.g. lampshades and fruit bowls from old vinyl records; sandals from old car tyres). In between these extreme cases was a huge collection of enterprises, which had never considered, or never succeeded in implementing ecodesign into their organisations.

This paper describes a project, carried out a decade after the above-named projects from the late 1990's, where the initial conclusion regarding ecodesign implementation was the same as ten years previously. The project, which was supported by the Danish EPA and the Confederation of Danish Industry, carried out a survey of ecodesign methods and tools; an extensive survey of the literature in the field of ecodesign; and a limited survey of a representative group of Danish product developing organisations (15 companies in total), regarding their readiness, experiences and needs in the area of support for ecodesign implementation. Following these surveys, five companies were chosen as active case companies, in which a guide towards ecodesign implementation was developed and tested.

The aim of the project was to create awareness and encourage activity, by providing a simple and inspiring guide to ecodesign, consisting of a few easy to implement steps for companies. The guide should be applicable by all types of companies – from large to small organisations; energy using industrial products to domestic objects of design. Furthermore the guide should inspire the product development project team to create space for environmental thinking in their development processes. To satisfy both the ambition of reaching the smallest of Danish companies and that of serving international operating organisations, the guide was completed in both Danish and English, and made available free of charge. Since the guide was completed it has been implemented further by the case companies involved and furthermore tested in a series of other companies.

During the initial surveys carried out in the project, a number of interesting results were achieved. Over

50 ecodesign methods and tools were identified and presented to the initial 15 companies. The vast majority of these methods and tools have their origins in academic research projects and dissertations, which have been developed into more or less commercially available tools for use during the product development process. It was found that an astonishingly small amount of these methods and tools were known by the 15 companies; even fewer were actually in use by the companies involved.

The literature survey revealed the development over time of various approaches to ecodesign and highlighted both new tools under development, as well as areas of application for these tools. The survey also made it apparent, which drivers and barriers exist to ecodesign implementation in companies. It was also apparent that many tools had been developed in a vacuum, with respect to knowledge of other existing approaches and industry needs.

The survey regarding companies' readiness, experiences and needs in the area of support for ecodesign implementation focused on a number of areas, as follows:

The level of environmental communication in the organisation
i.e. does the organisation have an environmental champion, visible environmental goals or visible environmental reporting?

The organisation of the environmental task
i.e. does the company's management have an environmental agenda, is time allocated for environmental thinking in product development, is there a focus on environmental competencies in the company?

The extent of collaboration and network
i.e. to what extent does the company involve external partners or actively engage in networking about the environmental task, are there initiated working groups in the company, are there environmental competencies in the companies project teams?

The types of ecodesign content and activities that the company has or supports
i.e. which particular ecodesign tools are used in the company, which methodologies does the company apply for environmental assessment and improvement, are there clear environmental goals for product development?

This paper will present and discuss the above empirical findings from the respective cases studies carried out as a part of the project regarding the creation of an ecodesign implementation guide. We will also discuss the issues of periodical renewal and renewed presentation of such guides, in order to ensure sustained activity and implementation of environmental thinking in product development. Finally we will discuss a series of elements for future research and empirical industrial collaboration, based upon the insights gained from this project.

6.3 Integration of environmental technology in modularised production systems in the automotive industry

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The automotive industry is facing a huge future challenge to reduce the environmental impact from new mass market vehicles. A number of new technologies are being developed in order to reduce the energy consumption and environmental impact. Vehicle manufacturers are for example collaborating with their component suppliers to develop electrical drivetrains, hybrid drivetrains and fuelcell drivetrains in order to reduce energy consumption and substitute the need for fossil fuels.

These technologies need to be fitted into the current vehicle production system before they can develop into attractive alternatives to the conventional combustion engine. Manufacturing of modern mass market vehicles is today characterised by trend towards modular design and modular production of core technologies fitted in cars. The idea behind the modular production system is to reduce costs in the vehicle production by fitting components into complete functional units that can be designed and manufactured independently. The modules are integrated in technology platforms which are used across models within groups of vehicle manufacturers. This system enables the vehicles manufacturers reduce development and design costs, increase scale in component manufacturing and consequently reduce overall production and development costs. If the new technologies are to succeed in the modern vehicle production system then they need to be developed and applied to features of the current production system. The purpose of this paper is to explore how the use of modularised production systems in the automotive industry can be combined with the integration new environmental technologies. The paper is based on research conducted in a PhD project. The paper is empirically based a number of case studies of component suppliers of environmental technology for cars.

The paper concludes that the technical modularisation in the production of environmentally friendly engine systems (such as the full battery electric, the hybrid electric and the fuel cell electric engine system) enables vehicle manufacturers to choose a flexible development path that allows multiple solutions to be developed simultaneously and thereby allow vehicles manufactures to make strategic changes during development stages if the technological development takes an unexpected turn. Vehicle manufacturers that chose to concentrate activities around developing the hybrid drive trains may therefore be able to re-use components and systems such as batteries, high voltage wiring, electric motors and brake regeneration system if, for example, the development of the battery electric vehicle or the fuel cell vehicle progress faster than expected. The technical linkages between the alternative drive trains additionally allow vehicle manufacturers to benefit from technological discoveries made in competing drive trains.

17.1 Alliance contracting – a business model to support sustainability and facilitate innovation and action on climate change?

Margaret Gollagher, Murdoch University, Perth, Australia

Alliance contracting – a business model to support sustainability and facilitate innovation and action on climate change?

Alliance contracting involves the creation of a contractual, commercial framework that optimises delivery of complex projects with risks that are hard to define, such as the design and construction of major infrastructure. It embeds the concept of partnering, developed by Charles Cowan, in a contractual context. In contrast to more conventional, adversarial processes, risk is shared by all participants and value-based solutions are sought. It is specifically designed to simulate innovative thinking in collaborative, integrated networks of government and business groups undertaking projects with critical time constraints and uncertain and changing scope. Community, stakeholder and environmental concerns are comparatively easily incorporated into projects via this business framework. It has also been demonstrated to be a cost effective way of achieving project goals.

In Australia, the alliancing model has been increasingly implemented since the 1980s in an attempt to avoid the costly disputes and litigation that previously plagued the detrimentally adversarial engineering and construction industry. It puts into practice a more cooperative mode of project delivery that, almost radically, underscores the importance of mutual trust and respect between project partners. Experience suggests that alliancing may be also particularly suited to promoting innovation and achievement of positive outcomes in relation to climate change and other sustainability issues by virtue of its emphasis on collaboration, relationship building, integration, innovation and inclusion of community and environmental concerns. This approach not only provides scope and legitimisation for the inclusion of sustainability issues as a fundamental requirement, but puts the necessary business culture in place to nurture it.

Alliance contracting has the potential to improve the development of infrastructure that may be in place for decades in the uncertain context of climate change. Those responsible for designing and constructing major infrastructure projects such as roads must consider the emissions associated with their construction, utilisation and decommissioning, as well as taking into account the impact climate change may have on infrastructure over the long term. This is a formidable task, requiring attention to resilience and adaptability, with new design parameters and drivers that may change radically over time in ways that are not easily anticipated.

This paper examines the theoretical and practical alignment between alliance contracting and sustainability, focusing on climate change. The Access Alliance, formed in December 2007 to construct a significant project to upgrade sections of a major highway in Western Australia's wheatbelt region, is used as a case study. The Access Alliance includes team members from designers Maunsell/AECOM, a contractor and representatives from the government agency, Main Roads WA.

17.2 System Innovation for Sustainability: A Risk-Based Double-Flow Scenario Method for Product Development Teams of Manufacturing Companies

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Due to the complexity embedded in the socio-technical system and associated long planning periods, system innovation is a research topic mainly of the science and technology policies area and not much effort has been put into investigating the means of involving companies and product development teams in planning for system innovation. Innovation at system level requires businesses to align their product/technology development decisions, strategies and business models with the society's long-term sustainability visions in a systemic way. In line with this requirement, this paper presents a generic scenario method developed to help product development teams of manufacturing companies in planning for system innovation. The scenario method was developed through:

· integrating theory from sustainability science, futures studies and system innovation for sustainability;

· carrying out a critical analysis of previous projects aimed to plan for and/or steer system innovation;

· carrying out a review of system innovation typologies, scenario typologies and methods; and,

· carrying out a review of drivers and barriers for businesses to adopt sustainability as a default business and product development priority and to undertake radical new product/technology development projects. This scenario method is novel for being systemic to link societal visions of sustainability to companies' strategic and product development decisions. The method uses a layered risk approach. This renders long-term thinking meaningful for businesses since contextual and business-related implications of generic sustainability risks are made explicit. A risk approach also enables considering not only environmental but also interdependent social aspects of sustainability. In order to link present reality and future aspiration, the method uses a double-flow approach unlike the previously used methods which use either backward or forward flows. This novel method can aid in meeting the world-wide challenge of sustainable development since it practically relates businesses and their activities to governance of system innovation.

17.3 Can Innovations in the Supply Chain Lead to Reduction of GHG Emissions from Food Products? A Case Study

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The R&D project *Smart Vareflyt* (Smart Flow of Goods) aims at creating more efficient supply chains with respect to both economic and environmental parameters. The innovation is based on utilising RFID technology in a supply chain setting to enable demand-driven production and replenishment. Thus, efficiency increases through collaboration and sharing of real-time and transparent information across supply chain actors.

The project is performed in collaboration between three Norwegian research institutes and industrial actors representing all parts of the supply chain, from fresh food and packaging producers to retailers. This paper describes a pilot case study involving the supply chain of fresh salad, in which an important focus is on how greenhouse gas emission reductions can be achieved and measured, as part of an overall increased supply chain efficiency.

Food and supply chains

Since fresh food is highly perishable, efficient production planning and supply chain management is crucial to minimise waste. In the Norwegian grocery sector today, production planning and supply chain control is often based on historic demand and event information such as past sales and forecasts, leading a time gap between sudden events and corrective actions [1]. Thus, there is substantial improvement potential with respect to responsiveness, stock turnover, and lead-times. In addition, ineffective information exchange and lack of visibility in the supply chain may lead to poor forecast quality and additional loops for adjustment and operational control [1]. Further, actors are often reluctant to share information with others in the supply chain for fear that it might disrupt the supplier-customer power balance.

These issues lead to less efficient supply chains where production is not based on demand, total costs are higher than necessary, and delivery service for customers poorer. However, just as important is the waste produced and its associated environmental problems. The amount of edible food waste is substantial, with most of it occurring in households, and a considerable amount at the retailers' [2]. A British study shows that 61% of household food waste is avoidable and could have been eaten if it had been managed better [3]. A substantial part of this waste is can be linked to lead times that are too long and the associated short shelf life.

The most significant environmental effects related to food waste are not the loads related to waste treatment, but rather the inherent upstream effects related to cultivation of crops and livestock, processing of these, production of additives etc. [2]. When food is wasted, all activities upstream and their related emissions are in vain. In other words: Avoiding waste through better utilisation of food means avoiding unnecessary GHG emissions.

Introducing demand-driven production and replenishment will enable reduction of lead times and increased delivery performance, thus leaving more time for consumers to consume the product until it reaches its expiry date.

Estimating impacts in a case study

In the *Smart Vareflyt* project three research institutions (SINTEF, Ostfold Research and the RFID Innovation Centre) are working closely with a number of leading fresh food manufacturers, packaging manufacturers, wholesalers and retailers in the Norwegian grocery industry. The objective is to collaboratively develop the supply chain control models that are necessary to support the application of RFID technology. Concepts from supply chain management are used to redefine collaboration among the actors [1]. focusing on developing:

New control concepts, principles and algorithms

Unified supply chain control models as opposed to individual actor control

Suitable collaborative models and contract types

Parallel to this innovation process, work is being done to estimate the potential effects of the implementation of RFID enabled demand-driven supply chains; and to further down the line enable the actors to register and monitor these changes. These effect estimations (i.e. indicators) will cover efficiency both in terms of logistics and the environment.

For the environmental effects, the focus lies on two main topics both having strong correlation to climate gas emissions, namely resource efficiency and distribution efficiency:

Resource efficiency:

The food waste

Packaging, especially regarding *Returnable Transport Items*

Distribution efficiency

Based on a theoretical framework, a number of indicators for capturing such effects will be integrated into an effect measurement system and methodology.

The environmental effects framework is based on a life cycle approach for improvement of environmental profile for producing, packaging and distribution of food products: 'Environmental Value Chain Assessment' [4] and climate gas accounting [5]. This will constitute the basis for the indicator system and enable a presentation of results on the salad case level, i.e. estimated impacts on environmental indicators resulting from changes in the supply chain.

Results and Conclusions

Through the *Smart Vareflyt* project companies were given time to learn about the new enabling technology and its possibilities and limitations through practical implementation exercises. In the later phases, focus has been shifted to the benefits of sharing information across the supply chain. The actors involved are demonstrating a growing readiness to increase collaboration and integration with supply chain partners.

The selected effect indicators are modelled in a specific supply chain case. Changes in GHG emissions will be estimated for a range of causes, such as reduced product loss and a variation in transport intensity.

At present, the hypothesis is that GHG reductions may be achieved through the proposed changes in the supply chain. The connection between the commercial and environmental gains makes the case convincing and increases the probability of enduring emissions reductions. There is, however, a danger that the changes will result in increased transportation and one therefore needs to ensure that the GHG reductions through reductions in food waste are not offset by GHG increases from increased transport.

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17.4 "But don't you want a Danish solution?" - Ignorance, denial, tradition and other transition elements in the 15 years delayed uptake of the Passive House concept in Denmark

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In 2007, the first house in Denmark was built according to the passive house standard. Several thousand of these low-energy buildings had by then already been built in Germany and Austria. Why was the adoption of the passive house concept so delayed when Denmark already had a strong tradition of developing low energy buildings?

In a Transition Management perspective, many of the prerequisites of a sustainable buildings niche were present in Denmark at a much earlier point of time:

- Existing building codes were continuously developed in direction of reducing energy consumption.
- Certain actors had a strong tradition for implementing promising new sustainable solutions
- Institutions and professional networks related to sustainable houses already existed
- Danish companies were internationally renowned for producing key technologies in the passive house sustainable buildings in high quality: insulation, windows, ventilation.

The empirical contribution of the paper is an elaboration of how the above dimensions performed individually in relation to introduction of the passive house standard in Denmark, and how they collectively through their alignment, constituted part of the Danish landscape of the built environment. Theoretically, the paper introduces a discussion on how technical standards can perform at the regime level to promote sustainable transformation. The paper concludes that the eventual success of the passive house standard in Denmark relies on the ability of the standard to redefine and translate key disputes and diverging interpretations of sustainable buildings.

18.1 Sustainable Innovation - organization and goal finding

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Sustainable Innovation – organization and goal finding

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Renee Wever, Delft University of Technology

ABSTRACT

It is often stated that to produce sustainability, incremental improvements will not suffice: reducing unsustainability is not the same as creating sustainability (Ehrenfeld, 2008). Radical or systemic innovation is needed but also a change in the pattern we search for new solutions. This requires stepping away from the old path, or as Ehrenfeld (2008) illustrates, we should not be "the drunk who lost the car keys but kept looking for them under the street lamp because that is where the light was."

To be able to step out of the 'beam of the street light' when searching for sustainable innovation, the organization needs to be designed accordingly and the design team at the fuzzy front end of the innovation process needs to be equipped with appropriate tools and methods. There is abundant literature demonstrating *why* corporations should go beyond compliance when it comes to sustainability (e.g. Elkington, 1997; Hawken, 1994) as well as *how* to design this commitment into products (e.g. Brezet & Hemel, 1997; Diehl & Crul, 2007; Tischner, 2000). The challenge lies with getting from 'why' to 'how': *who* is making it happen and *what* are the products that will be produced? (Figure 1). The *who* and *what* have received far less attention than the *why* and *how*, Boks (2006) being one of the notable exceptions regarding the organizational side and Wever, et al (2008) regarding the goal finding.

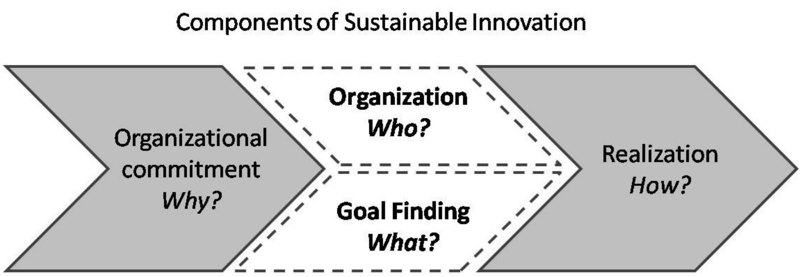

Figure 1. The 'why' and 'how' are extensively addressed by existing literature. 'Who' and 'What' remain still ill-addressed.

In dealing with the 'who' in figure 1, Piasecki et.al (1999) argued that the nature of environmental management over the previous few decades had been defined by regulatory structures but a new approach was emerging and a new vision was needed to drive environmental leadership further. Piasecki et.al (ibid) went on to highlight that there was a major change emerging in the field of environmental management and it is environmental leadership that will be crucial as to whether futurist environmental management would succeed or not. The *green wall* (ibid) is a point where the entire organisation refuses to move forward with its environmental management program. According to Piasecki et al. (ibid), the reasons for hitting the green wall includes negative or deferred decisions due to a lack of management support for the environmental management concept and programme. Also, due to the inability to demonstrate attractive returns on further investments in the environmental programmes, to others in the organisation. Traditionally, best practice environmental management organisations have had difficulty to adapt their organisations into the business enterprise.

What comes to the 'How' (Figure 1), there is an array of existing ecodesign tools that guide the design team in the design process. However, these tools are meant for a phase in the design process, where the idea and specifications for the product have already been decided, and only incremental changes regarding the products sustainability can be made. (Wever, Boks & Bakker, 2008; Ölundh & Ritzén, 2004) Therefore, it is crucial to take sustainability into consideration already in the early phase of the design process, often referred to as the fuzzy front end (FFE) (Buijs, 2003). It is at the FFE that the company realizes the need for innovation, generates ideas, identifies opportunities, and develops a concept of the product idea (ibid). The FFE still remains ill-addressed in the existing sustainable design literature (Wever et al., 2008).Yet, identifying possibilities for sustainable innovation takes place in this phase.

If we accept that sustainable innovation involves moving from the design of individual products to the design of whole systems, it can involve new mixes of products and services, new patterns of ownership, or shared/communal use of products. It might involve replacing physical products with a 'dematerialized' service or even questioning the extent to which a product or service is really necessary (Roy, 2006). How do we move beyond the current status quo? The current technical 'eco-efficiency' approach to environmental sustainability is more likely to be adopted in the short and medium term. What however is needed is an organizational change that allows a move to radical, socio-technical sustainable innovations. The research on the '*Who?*' suggested in this paper will look into how organizations recruit, select, develop, and support the key decision makers in order to facilitate sustainable innovation. Also, how could they identify these people and how the development of 'creative networks' could be facilitated.

Possibilities for sustainable innovation need to be identified during the FFE. To support this, methods to identify sustainability innovations need to be created. In these methods, sustainability must be presented as a driver for innovation and value creation, instead of merely a boundary condition. The methods should assist companies in answering the question '*What can we do to create sustainability?*' in a manner that increases the value recognized and received by the end user and the company itself. Also, a well thought through product portfolio strategy is crucial in this phase. The research on the *'What?'* suggested in this paper looks into cases of sustainable innovations to identify elements of a successful sustainable FFE process, and eventually generates methods for innovating for sustainability at the FFE.

This paper is a position paper of the proposed research projects of the authors. This paper will review and discuss the current body of literature on sustainable product innovation, identify the gaps and present proposals for research. These gaps can be seen in figure 1 and are the 'who' and 'what' boxes. The 'who' will explore the persona of the key decision makers in terms of new transformational strategies (Ehrenfeld, 2008). Next to this is the crucial 'what' box that explores the front end activity in sustainable innovation. The paper brings together the 'who' and the 'what' in the journey towards the 'possibility of allowing all life to flourish on earth' (Ehrenfeld, 2008).

18.2 Spelling the Domain of Sustainable Product Innovation Research

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Bringing scientific disciplines together is increasingly seen as a factor that can strengthen a particular scientific research approach. This has in particular been noted for the field of sustainable product innovation, which builds on disciplines such as Environmental Systems Analysis, Product Development, Product Design, Engineering, Economics and Business Administration, Consumer research and Operations management. With so many scientific fields forming the backbone of sustainable product innovation research, it is no surprise that relevant research furthering sustainable product innovation is done within various scientific domains.

This observation fuels discussions on the need to define what is to be regarded as part of the sustainable product innovation (SPI) research domain, and what is not. In order to answer this question it is necessary to focus not only on *topics*, but also on research *methodologies* used (case study research, explorative research, descriptive or prescriptive research), *case studies* analysed, and *theories* used (such as innovation theory, institutional theory, organisational learning, entrepreneurship, technology management, or design theory).

A recent survey, carried out under the umbrella of a Nordforsk funded project bringing together PhD supervisors in the Nordic countries, has identified over 200 completed PhD research projects that address research questions relevant within the SPI domain. An initial attempt to map and/or visualise past and present Nordic research into sustainable product innovation has lead to a map proposing five dimensions, which together should describe any piece of research within the SPI domain. Each dimension can further be broken down into three or four levels of contributing aspects.

Research aim. Here, a general distinction can be made into prescriptive and descriptive research. *Descriptive* research usually takes a level of either explanatory research, thick descriptions of societal phenomena, with or without the ambition of theory extension, which can in turn be through for example modeling or hypothesis testing. In contrast, *prescriptive* research is considerably more popular and can take many forms. Distinctions can be made in audience (companies of different size, consumers, and policy makers), types of outcome (management tools, policies, creativity tools, evaluation tools, etc.) and ambition level (ranging from incremental improvement, product innovation, function innovation, to system innovation).

Research method. It is suggested that research in SPI usually depends on either 1) field or *case study research*, using various techniques such as questionnaires, experiments, interviews and observations, 2) *literature research*, both on theoretical domains such as organizational theory, institutional theory, actor-network theory, as well as engineering-type literature. 3) *action research*, which is popular in studying industrial innovation processes in real time, and 4) various types of *modeling*, including life cycle modeling and various types of economic modeling.

Level of analysis. Here, four levels can be distinguished, 1) artefactual (components, products), 2) organizational (institutions, industry sectors, companies, departments, individuals such as designers), 3) technological, and 4) societal, focusing on policy, culture and/or public or private actors.

Object of analysis. Here, a number of objects can be distinguished, including processes (management, technical, etc.), phenomena (such as trends or controversies), infrastructures, actors, but also environmental data, policies or product categories.

Stage of the product life cycle. Here again, different sub-dimensions can be used to distinguish sublevels, mainly using the life cycle stages of the product itself, or using a developmental focus, distinguishing between fuzzy front analysis, idea and concept generation, detailed design, commercialization, etc.).

In order to exploit to the best of our ability existing and future research, it is meaningful to discuss, among other things, how departmental research evolves, and how researchers have extended and elaborated on each others' theories and scope. Generally departments evolved from studying disciplinary research questions (be it theories of technical systems, theory of dispositions, environmental impact assessment, product disassembly, environmental technologies, and resource efficiency) to more overarching themes, such as superartefactual environmental problems and augmented product thinking, actor- and user thinking, product stewardship, environmental management of industrial systems, integrated product policies, environmental technology transfer, sustainable consumption and corporate social responsibility.

A related question is to determine how scientific research on the PhD level has been disseminated by successive generations of students that have obtained their PhD degree. To what extent has knowledge and expertise been transferred from research institutes to, and adopted by, industry, government bodies and NGOs, not least by the researchers themselves. Do LCA researchers end up doing LCAs? Do companies that employ people with PhD degrees benefit from trans-disciplinary scientific insights and expertise?

This paper aims to discuss the questions put forward here. The method of analysis is a partial analysis of the extant body of PhD dissertations within the sustainable product innovation field as published in Northern Europe. Focus will be on the Nordic, Dutch and British regions, as research at universities there represents perhaps a unique kind of multidisciplinary, creative school of research, as opposed to a more engineering and quantitative orientation elsewhere in the world. Selected interviews with representatives of this research school that now work academically, industrially, or in policy making, will inform this discussion.

The result will be a reflection on what can be regarded as the scientific research domain covering research supporting sustainable product innovation, including learning from historical developments, towards future research strategies and their industrial application.

18.3 Design Study for a European LIVING LAB Research Infrastructure to stimulate the adoption of, sustainable smart and healthy innovations around the home

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Extended abstract
Presentation:
Design Study for a European LIVING LAB Research Infrastructure to stimulate the adoption of, sustainable smart and healthy innovations around the home.
The LIVING LAB project is a design study within the 7th Framework programme for research and technological development of the European Union. The aim of this project is to develop the conceptual design of the LIVING LAB Research Infrastructure that will be used to research human interaction with, and stimulate the adoption of, sustainable, smart and healthy innovations around the home.
LIVING LAB intends to bring together Europe's top research institutes and companies and aims to stimulate co-operative projects in the fields of user centred research and product development.
Living Labs address some of the difficulties that occur in the course of an innovation process. Worldwide, 85% of development efforts are spent on products and services that never reach the market. At the same time, the experts often totally underestimate the market potential of many products and services. Living Labs are an approach to stimulate user-driven innovation, which can lead to better understanding of customer needs and thus to more successful innovations.
The LIVING LAB project tries to utilize the advantages of a European research infrastructure to foster sustainable products and services. Sustainable products, or eco-innovations become more and more important in the face of the challenges Europe is confronted with: climate change and energy use, overuse and depletion of natural resources, ageing populations etc. The trends in all these fields are developing in unsustainable ways, leaving a need for innovative technologies, products and services that contribute to energy conservation, sustainable consumption and a high quality of life. Many of such innovations were developed in the past, but the social acceptance and market uptake of these has not been very successful. Home domotics, PV systems and water re-use systems are a few examples of promising domestic technologies that are still waiting to happen.
The LIVING LAB research infrastructure will explore the consumer's point of view of sustainable and quality-of-life-enhancing innovations. The project is supposed to gather insight in the consumer's motivations for using (or not using) these innovations, and work with industry to develop alternatives with a better chance of succeeding in the market. Considering consumption and production as parts of a systemic entity, research can be placed along the whole value chain and comprise all stages of the innovation process.
Hence, the objective of this design study is to address all key issues related to the feasibility of a new research infrastructure with a clear European dimension that will:
* advance the field of user centred research
* test, evaluate and improve sustainable innovations for the home,
* foster societal needs such as sustainability and quality of life,
* stimulate competitiveness of European industry.
Breaking new ground in the fields of consumer adoption of sustainable products, applied ethnography and participatory design & architecture, the LIVING LAB research infrastructure will provide the ground for generating new methodical insights into user-centred development, alpha-testing products and services in physical LIVING LAB houses and beta-testing in the field.
the LIVING LAB core infrastructure will look like an ordinary house, but invisible to its inhabitants who are all volunteers it will have sensors and other equipments that record every aspect of home life. The behaviour and interactions of the inhabitants can be monitored at any point in the day throughout the

duration of their stay. One key advantage of the LIVING LAB over other simulation setups is that products can be evaluated in a real-life environment, over a prolonged period of time. This way, researchers and product developers can achieve a deeper understanding and uncover valuable insights about how people interact with products, leading to the development of better products, with real benefits for consumers and a better chance of succeeding in the market.

As the LIVING LAB research infrastructure will be made up of several LIVING LAB centres and affiliated research institutes and corporate labs, networked across Europe, parallel research in several facilities can be done, as well as studies into cultural diversity of European consumers.

At the moment, the project is in a very intensive phase, elaborating a Strategic Research Agenda and, thereby, developing and charting a whole new research landscape.

18.4 A reflexion on the consequences of multifunctionality on long term sustainability with district heating as a case study

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More and more initiatives at the local, national and international level are taken to tackle the problem of climate change. In that context Mr. Tanaka, executive director of the International Energy Agency mentioned, in a recent speech in Poznan, strategies that government should follow to "lock in sustainable technologies and reduce CO_2 emissions". Even though it is undeniable that large scale implementation of sustainable technlogies should be promoted, facilitated, and even locked-in, we should however remain cautious. Indeed, there might be a risk that technological systems with clear short term environmental benefit create a lock-in for longer term transition to sustainability. This is especially relevant when, in order to optimize their (environmental) performance, two systems with previously separate functions are integrated. The resulting multifunctionality could have positive as well as negative consequences on long term sustainable innovation potential. Using district heating as a case study, this paper intends to raise awareness in relation to this issue.

District heating is seen by a number of countries as one of the strategies necessary to decrease CO_2 emissions and make the transition to a sustainable energy system. Indeed, it can: valorize energy sources that would otherwise be discarded such as industrial waste heat; be generated by combined heat and power, increasing overal system efficiency; or make use of renewable energy sources such as biomass, geothermal heat and solar energy.However, some scholars are adopting a more cautious position and suggest that the presence of a district heating system can, as it has been experienced in Germany and Sweden, slow down the implementation of low energy houses. Indeed, in such a system, the costs of the infrastructure are high and in areas where linkage to a local district heating network is compulsory, developpers may not have an incentive to invest both in the district heating and in technologies to decrease the energy demand of houses and buildings. Moreover, when industrial waste heat is used as an input, the heat produced during industrial processes changes from being considered as waste to being considered as a by-product of economic value. As such, industries may not be willing to invest in innovations that could increase their efficiency. As a result, district heating can cause a lock-in both in the input and in the output side resulting from economic, technical and institutional barriers.

Nevertheless, when analysing possible causes of lock-in, the inherent and potential multifunctional character of district heating have not fully been considered. Indeed, first district heating is usually used to provide heat both for space heating and domestic hot water, applications for which the demand in term of quality differs. Second, it is very often linked to a cogeneration unit, integrating the district heating system with the electricity system. Third, in summer, when heat demands are low, the district heating network can for instance also be used to deliver heat to absorption chillers that can in turn produce chilled water for cooling purposes. This is the case in Copenhagen for example. Fourth, cogeneration can also be considered as one of the options for demand side management if proper heat storage is developed. And finally, Hemmes et al are investigating the possibility to use internal reforming fuel cell for the tri-generation of heat, power and hydrogen. The hydrogen could be used to power fuel cell vehicles, in which case the district heating system could indirectly be linked to the transport system as well. In summary, a variety functions are and could be associated with district heating energy system.

The consequences of this (potential) multifunctionality on long term sustainable innovation potential, be them positive or negative, have not yet been investigated schematically. On the one hand multifunctionality implies technical and economic interdependencies, as well as legal possibly political commitment. All these aspects are known to increase the risk of undesirable locked-in. On the other hand, multifunctionality also allows the combination of different level of expertise which could lead to the discovery of new possible connections. This could increase the system's capacity to innovate, facilitating transition to a sustainable mode of development.Using district heating as an example, we have tried to show that long term consequences of a given technology or technological system on sustainable innovation potential are difficult to evaluate. It is even more so when the system is or can perform multiple functions, creating connections between various actors, each with their own needs and requirements. Moreover, we must acknowledge the fact that by continuously questioning the long term consequences of technologies, we face the risk of not taking any constructive decisions. Besides given that the future can not be predicted with accuracy, we can question how much of these consequences can actually be foreseen. However, despite this uncertainty, it worthwhile to investigate necessary conditions and to develop strategies under which potential threats can be turned into opportunities.

18.5 Tri-generation in the built environment

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Nowadays the world is facing large sustainability challenges especially when it comes to energy provision of the – growing – world population. Not only the supply of fossil fuel is limited, but also exhaust like SO_x, NO_x and CO_x either directly pollute the environment and affect air quality or contribute to the greenhouse effect.

A proven concept to increase efficiency of energy production is cogeneration. By co-producing electricity and heat, efficiency can rise up to 100 percent because all heat produced as by-product of electricity generation is used for heating. In several countries, like the, the cogeneration concept is downscaled and implemented at district level (meso-cogeneration varying from 5-500 kW of electrical power) or even at household level (micro-cogeneration up to 5 kW of electrical power). Downscaled cogeneration fits within the category of decentralized energy production.

To avoid the waste of heat, in general heat demand determines the amount of operating hours - as electricity will either be used or fed into the net whereas feasible transportation possibilities of heat are rather limited. This implies that the electrical efficiency of the cogeneration system should be as high as possible to minimize co- production of heat.

Four technologies for cogeneration are common being the engine which has an electrical efficiency up to 25% of which only 15% is proven in practice; the gas turbine which has an electrical efficiency up to 43%; the piston engine with an electrical efficiency up to 35%; and fuel cells which can have an electrical efficiency up to 60%. In general the larger the system is, the higher the electrical efficiency and the lower the maintenance costs. Moreover when the electricity-efficiency of a cogeneration system increases the amount of fossil fuels needed decreases. Additionally the emissions decrease, next to that because electricity is more expensive than heat, the economic feasibility of the system increases.

Currently most market developments in the are directed towards micro-cogeneration systems based on technology, which have the lowest efficiency for electricity generation – but do have a total efficiency of nearly 100%, thus produces a lot of heat. As the main limitation of this system is that the quantity of electricity produced is directly dependent on the heat demand, this contrasts the argumentation above. Because on the one hand, in periods of high heat demand, the electricity grid must be able to accommodate for the large amounts of electricity generated. On the other hand in periods of low heat demand the installations are used at partial capacity or not used at all, which decreases the feasibility of the system. Moreover our dependence on central power plants for electricity generation remains as in summer decentralized cogeneration will hardly be used.

Current cogeneration systems are lacking the flexibility to adapt to power demand and price. In this paper we will explore the innovative concept of tri-generation using the thermodynamic possibilities of an internal reforming fuel cell for flexible heat, power and hydrogen production. In an internal reforming fuel cell natural gas is converted into hydrogen which is converted by the fuel cell into power and heat. However, when increasing the input of natural gas, more hydrogen can be produced than is needed by the fuel cell for its own consumption. Hydrogen can thus be extracted and becomes a third product of the fuel cell, next to electricity and heat. Moreover, heat is converted into hydrogen because the reforming reaction is endothermic. In other words: because chemical energy is produced, less waste heat results. Thus, system efficiency, in terms of hydrogen and electric power production can be increased up to 80 - 90%. This means only 10-20% of waste heat results.

The flexibility of the tri-generation system is even more important. Within certain limits large variations in production ratios of the various products of the system can be obtained, being electric power, hydrogen and heat. This flexibility can be used in the built environment in a combined heat and power application. The flexibility of the fuel cell can thus be used to adapt heat production to local heat demand. Moreover, in times of low heat demand, the installation does not stand idle but can be used for hydrogen production instead, increasing potential profit and thus overall economic feasibility. The hydrogen produced can for example be used for fueling fuel cell vehicles of the local residents; moreover the amount of hydrogen produced can be adapted to the (growing) demand for hydrogen for transport. Finally, the flexibility of the fuel cell on the input side can be used to mix locally produced biogas in almost any mixture with natural gas to fuel the fuel cell. Moreover, in a context of decreasing energy demand for space heating, this concept can be part of the transition to low temperature district heating. The potential of the concept of tri-generation for a further transition to a more sustainable energy supply will be explored and compared to other options in terms of feasibility; sustainability now and in the future; implementation aspects; and the prevention of undesirable lock-in effects. The paper will describe the advantages and disadvantages in terms of efficiency, feasibility and compatibility with the desired transition.

30.1 A new role for eco-design: envisaging future systems, revealing the hidden present

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The single most important driver for eco-design is climate change which requires revolutionary restructuring of systems of production and consumption, including technology, business, infrastructure and life-styles. Continuous, incremental, improvements will not suffice; ecodesign has produce rapid systemic change in socio-technical systems. This presents a truly challenging task. Nothing like this has confronted human society before; it demands a level of collective intelligence, foresight and purpose and a social commitment to experimentation and change that is truly unprecedented.

A design research and visioning project in Australia, the Victorian Eco-Innovation Lab (VEIL) has two years of work to "change the landscape of expectations" of a sustainable future. The project enlists designers, researchers, government policy advisors and design students in four universities to generate visions of (possible) sustainable futures.

This paper provides an opportunity to reflect on a model of future design visioning that has been evolving through the VEIL program. VEIL aims to intervene in the 'conceptual market', the field of future consumption possibilities in which people live out their daily lives. The process has used a literary device to focus productive engagement in future visioning – a series of documents describe a "retrospective history of the next 25 years" to elaborate the 'drivers of change' that have shaped the unfolding future. This deliberately leaves open the resultant physical and organisational outcomes of the forces described; visioning is then the creative task of exploring and co-producing (many) possible configurations of daily life that could have resulted from such forces. As the project has limited resources for detailed modelling a process of 'feedback' has been devised as a new form of 'back-casting' in which the critical methodological components have become: the idea of 'plausible testability'; the concept of 'trajectories of development' and 'revealing the present'.

30.2 Design as a problem and design as a solution for sustainability

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Design as a problem and design as a solution for sustainability

The role of industrial design has been essential in the definition of an industrial model based on large production volumes for broad markets, but they have also contributed to the maturation of such a model towards sophisticated production platforms and product architectures, which allowed industrial production to customise solutions for smaller target groups.

Because of such strong link between the design discipline and the evolution of industrial system, this discipline is particularly sensitive to the question of sustainability. However the need for a decisive change of perspective for designers is not just a necessity, but also an opportunity to propose new design-oriented scenarios for sustainability.

Redefining the role of designers

The question of sustainability would radically reverse the way to look at design: if in the industrial system design represented that part of the industrial system that translated technical possibilities into material products , the evident unsustainability of this system suggests that designers are in fact part of the problem. If economic development models are based on quantitative growth, on the use of more products and consequently on the circulation of more material and on the use of more resources, designers' work has been one of the strongest support to this trend and therefore they have been contributing to make this development more and more unsustainable.

The debate about the redefinition of design's role and competences has emphasised that the border line between old and new perspective for design and for industrial production cannot be clearly defined, but it could rather be seen as a blurred transition zone in which the old paradigm has been criticised, although being still in place, and the new one has been progressively developed, though it has not found consolidated forms.

Beyond the limits: designers and quantitative growth

Since the earliest evidences of the limits in the existing development model a part of the design community started an exploration of new scenarios for well being, in which the satisfaction of user needs did not necessarily implied the production of new products. In such scenarios the focus on products' material features was replaced by a new interest in how products and services are used. A discussion focused on the usability of products and services provided a broader frame to the earliest designers' effort to work on a strategic turn consisting in a radical change in the way design is working for industry and for society: Such change is characterised by some fundamental landmarks:

· Designers need to shift their focus from products to services;

· The idea of comfort, which lead industrial strategies, need to be replaced by strategies for users' activation and participation;

· Industrial companies should consider forms of individualisation of solutions beyond the present framework of mass customisation

· The new solutions for sustainability should no longer consist in finished products, but rather in platforms for solution-oriented partnership

From Products to Services

The measurement of quality and well being of people should no longer be related to quantitative growth, but rather to individual capability to satisfy basic and complex needs. This approach is consistent with a strategic shift of business companies, which are no longer focusing on product, but rather on service provision. In the perspective of sustainability this focus shift is a promising chance to reduce resource use.

The focus on services leads designers and companies to work on the interaction with users. A user-centred approach reshapes the role of business companies within the production and consumption system; it propose that those companies be no longer the *producers* of products and services, but rather the *organisers of value creation systems* in which different actors including final users, will play an essential role.

Revising the idea of comfort: designers and users' activation

The concept of *comfort* has been shaped, in the last decades, by the idea that human work and personal involvement could be replaced by products and services provided by business companies. Such idea of comfort is therefore causing a progressive inability of people to express their needs and to solve their problems.

New phenomena, such as globalisation, and radical changes in the structure of society require a different level of people involvement in new solutions. Such solutions must be based on a paradigmatic change in the organisation of production and consumption systems, with relevant revision of the value creation system, and with the involvement of a *constellation* of actors, including users and other actors immediately around them.

Beyond mass customisation

Despite the increasing industrial capability to *mass customise* products and solutions, the level of individualisation and localisation of the demand would press companies for an effort that would exceed any economy of scale. A new perspective is emerging, in which designers and industries will work to harness individual capabilities to generate innovation and to define their own solution. The level of individualisation allowed by such collaborative systems may open perspectives that exceed the existing mass customisation strategies.

The new initiatives will need to focus not only on technological possibilities, but also on the social change. One of the critical factors for the success of those initiatives is a different organisation of knowledge, including both the technical knowledge of companies and the tacit and latent knowledge embedded in a local context. The focus on local context is also a promising approach to reduce resource use.

Platforms for solutions oriented partnership

The monolithic image of companies as sole owner of technical knowledge is continuously challenged by cooperative initiatives of users who modify existing products and generate innovative solutions. The idea of value-coproduction is suggesting that innovation be distributed, instead of centralised. This model of innovation has also a good resilience in case of major environmental changes. In this business companies should expect the outcome of their activity to consist no longer in a set of finished material products or defined services, but rather in *platforms* on which different actors, including local service providers and users, can create *solution oriented partnerships*.

ADDIN EN.REFLIST

30.3 Model for a Sustainable Energy Concept for Austria

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In many countries such as Austria the energy demand is mainly covered by fossil fuels. Over the last decades the negative impact of fossil fuels on the climate became apparent and has been largely investigated. Furthermore the usage of fossil fuels can not be durable and stable over a long time period. This brings up the need for modelling a possible future energy system using solely renewable energy sources.

The goal of the project ZEFÖ is to compare and possibly match the energy demand of Austria with the long-term potentials of Austria's renewable energies. Different possible full coverage scenarios of the energy demand should be visualized and analyzed, while taking into account the trade-off between using biomass for food, for animal feed, for material usage and for providing energy carriers.

To reach this goal we developed a static model of different energy demand scenarios versus all the different energy sources available per year. The model contains many parameters for an easy change in the settings on the supply side as well as on the demand side for studying the influence on the balance. We use a top-down modelling approach for the energy balance using statistical data and we employ bottom-up modelling for parts of the system where this seemed necessary, due to high efficiency or trade-off potentials.

Varying parameters also allows to examine the effects of enforcing or reducing various energy supply and energy conversion technologies. The profound modelling of the areas of space heating (including hot water) and mobility on the demand side makes it possible to consider changes in the structure of buildings, the population number and the mobility behaviour, as well as the transportation structures. The forestry and the agriculture areas on the supply side are also modelled bottom-up to be able to simulate changes of the alimentation behaviour, the woodworking industries and the agricultural system. The total effects of such changes on the energy system and its balance can then be looked at and analyzed.

Technically the model is realized in the object-oriented programming tool GaBi by a functional combination of processes. The most processes describe a conversion of energy/material into a different form, e.g. a wood stove converting 1 kg dry wood into 20 MJ heat. But also the correlation between area and energy or energy and energy services is realized through processes. Connecting the processes via flows and sub-modelling processes hierarchically allows for modelling even the most complex energy systems.

Our conclusion is that - against common opinion - it is possible to provide full coverage of Austria's energy demand by just using renewable energy sources, even with the still existing technologies. However there have to be significant changes in the structure of buildings introducing high construction standards to reduce the loss of heat drastically and mobility technologies have to change towards electrical drives having much higher conversion efficiencies.

30.4 Explicit climate investments as a tool for societal advancement

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During the recent decades of the industrial era most of the industrial business development has been aiming for growth, efficiency and economics of scale. Great advancements have been made through global trade, standardisation, automation and mass production. The total global production is much higher today than it was some decades ago. One major problem is that the use of fossil energy sources has resulted in an escalating global warming. Another aspect of the problem is that the quality of life output in the so called rich countries can be questioned, in particular in relation to the massive impacts at the other end of the global supply chains. The total effect is that the "rich" people's consumption of garments and "toys" sometimes is based on working conditions that ought to be described as slavery, and also abuse of Nature. However, many of those connections are hardly visible, they are hidden somewhere in the global trade systems and the massive industrial production system. In many ways the present trade and production system is efficient, i.e. doing the things right. But is it effective, i.e. doing the right things?

The subject area of Human Ecology questions the dualistic anthropocentric way of thinking, as being to mechanistic and narrow-minded. For example, humans are building ever larger fishing fleets and more efficient fishing ships, so that ever more fish can be harvested from the seas. It seems as if the business development thinking is limited to how the respective company can catch more of the available fish. Looking at what actually happens it seems as if the modern society has forgotten the fundamental importance of the maintenance of the fish population and ecosystems. One background reason why this happens is that the systemic effect is invisible when the fish meat is sold in supermarkets.

During the industrial era it seems as if the most influential humans have been promoting technological development and business growth for its own sake, hardly thinking about the consequences. This is not so strange when the connections are invisible and the main business development idea is to promote efficiency improvements through a focusing on the core business (only) and ever more lean (mean) production, within what is being done.

Statements such as Sloan's "The business of business is business" and Porter's reasoning that, "those companies which are able to achieve competitive advantage – that is, above-average performance in an industry sector – are able to reinvest this additional profit into the activities that created the advantage in the first place" have often been (mis-)interpreted to have a single-minded focus on (short-term) profit. It is important to think more intelligently about what it actuality was that created the advantage. Obviously, it was not the profit of present kind of production, but the creation of the present business system, based upon past profits and earlier learning and renewal oriented investments.

To enable a sustainable development it is necessary to invest an appropriate part of the present profit in development of businesses for the future. However, it has always been difficult to change the established structures and the conventional ways of thinking. In Schumpeter's vision, there is a need for innovative entrepreneurs to enable the kind of change process that is needed to achieve the kind of development that we now talk about as a sustainable societal business development.

This paper builds on experiences from four case studies of entrepreneurship and collaboration as means for sustainable innovation. The case studies include experiences from advanced leadership training, the Øresund Science Region innovation system, mobility of sustainability expertise and Swedish business developments for hardwood. The studies focuses on recent attempts to enable a more effective learning, collaboration and renewal and the case studies are based on 3-20 years background experiences in developments within the respective companies and clusters. Two of the cases employ "triple helix" collaboration between companies, research and the public sectors. A basic theory for how the connection to the future is accounted as investments and depreciation of capital is used in analogies that explain why investment thinking is relevant also within the climate dimension and how the understanding of material recycling can be used as a metaphor to clarify the global warming significance of motivation and learning.

Earlier studies have evaluated the entrepreneur as a driver in renewal oriented development processes. This paper focuses on investments in explicit developments and their visualisation as a tool to enhance the prospective motivation among the people within the local communities, companies and clusters where the investments are being made.

30.5 No smooth energy transitions in sight - experiences from the turbulent history of renewable energy

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No smooth energy transitions in sight

- **experiences** from the turbulent history of renewable energy

Wind energy and biogas are today considered economically feasible renewable energy solutions, even though there still might be controversies on costs calculations and CO_2 emission reductions. This has not been the case during the three decades of technological improvements since these renewable energy sources were taken up (again) following the energy crisis in the early 1970's. Political controversies and radically changing economic assessment as well as technical constraint bound in the design, systems and material agency of the technologies have made this process rather uneven and implied radical shifts in both the actor alliances involved and in the engagement of regulatory measures and knowledge. The involved political, regulatory, technical, and value changes serve as very good test-cases for a transition that in the coming decades will continue with even more controversy and involving further radical changes in technology and energy use practices.

The paper will explore how the interwoven relationship between renewable energy technologies based on wind and biomass, co-generation plants primary based on fossil fuels and institutional and regulatory changes have formed the Danish and European power and heat energy system so far. This implies radical shifts and continued controversies not only in priorities and political goals, but as much in the means and frameworks that set the economic and institutional conditions for change. Also the visions related to technologies and their improvements based on practical experiences and preferred solutions play a delicate part in this transformation. Even the content of goals and measures of sustainability have not been stable, and still a transformation has been initiated though not based on clear sighted management nor taking a straight pathway for change. The ability to adapt to changing conditions during a transformative process of change seem to be the rule, not the application of single measure models and strategies lasting over long periods of time. This challenges the involved regulating bodies, institutions, and stakeholders as they have continuously to adapt and translate their goals and applied measures to the changing conditions. Infant technology support, niche strategies, marked based pull mechanisms, reorganised institutions, marked creation, specific policy measures, etc. all have their time and may end up countering intentions if not adjusted.

Important lessons are to be learned about technology improvements, challenges to the prediction of outcomes, and the need for continued adaptations of energy innovation strategies and regulatory policies in a continued climate of controversy over means and ends. A focus on transition management has to be substituted for a multi-stakeholder and controversy laden framework to understand and give advice concerning sector and societal transitions.

31 Eco-Design and Product Development

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Overview: The Ecodesign Implementation workshop will be held by members of the Design Society's Ecodesign Special Interest Group. Our approach will be to take a series of different views on one common industrial product, regarding its environmental properties and improvement potential. This way, one common object will act as a vehicle for the benchmarking of different environmental analysis and synthesis approaches, allowing the active participants in the workshop to compare and discuss their methods and recommendations.

All are welcome to participate in the workshop and observe the activities of the session. Furthermore we invite volunteers to become active participants in the workshop, in order to apply their own methods on the common product. We have room for 2-3 more participants. The workshop will sum up into a discussion of the merits and challenges of all approaches applied and especially also to the challenges of implementing ecodesign tools into real life industrial contexts.

42.1 Stakeholder and user involvement in backcasting and how this influences follow-up and spin-off

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It has been widely shown that participatory backcasting is an excellent approach to explore system innovations and transitions towards sustainability (e.g. Quist and Vergragt 2006, Quist 2007). Since the early 1990s sustainable futures have been explored in backcasting experiments, numerous stakeholders have been involved and follow-up steps have been planned in line with envisaged sustainable futures. But what is the impact of these so-called backcasting experiments ten years later and how does this relate to stakeholder involvement in the backcasting experiment?

This paper reports on the first study that has systematically investigated the follow-up, impacts and spin-off of backcasting experiments in the Netherlands seven to ten years after completion, while this is linked to the characteristics of the backcasting experiments themselves (Quist 2007). It presents three cases dealing with subsystems within the food and agriculture production and consumption system: (1) Novel Protein Foods and meat alternatives; (2) Sustainable Households and Nutrition; and (3) Multiple Sustainable Land-use in rural areas.

The cases show that participatory backcasting may, but does not automatically lead to substantial follow-up and spin-off. If substantial follow-up has been found after 10 years, it is still at the level of niches that are potential seeds for system innovations. Emergence of niches and spin-off also comes along with the diffusion of the visions generated in the backcasting experiment, though these are influenced by the exits and entries of stakeholders. The developed conceptual framework applied for mapping the follow-up and spin-off of backcasting experiments uses network aspects derived from industrial network theory (building on Håkansson 1987) vision aspects (building on Dierkes et al 1996) and institutionalisation. The framework has relevance for monitoring system innovations and transitions towards sustainability.

The paper identifies what factors explain the extent of follow-up and spin-off of backcasting experiments, with a strong focus on stakeholder-related characteristics, such as stakeholder participation, actor learning and participatory vision development. In order to map stakeholder involvement, various aspects are derived from a number of actor and stakeholder participation theories (e.g Arnstein 1996 & Van de Kerkhof 2004), such as stakeholder heterogeneity and stakeholder influence. It appeared necessary to propose additional aspects that were not part or regular stakeholder participation theories, like type of involvement (not only time, but also knowledge and funding) and the degree of involvement. It is concluded that stakeholder participation aspects show a strong link with the extent of spin-off and follow-up. However, different roles and groups can be distinguished in different phases, which has to be taken into account when preparing and designing a specific backcasting experiment

This pleas for strong stakeholder involvement as well as strong stakeholder influence; it will be discussed what could be advantages, disadvantages and conditions. One underlying question seems to be who the users are: are regular stakeholders the main users, or should stakeholder involvement in system innovations and transitions to sustainability be extended to a range of end-users and citizens?

KEY WORDS

Impact of backcasting; stakeholder participation, end-users; system innovations and transitions to sustainability; meat alternatives; multiple land-use, sustainable food consumption; meat alternatives,

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42.2 Combat climate change – do open innovation methods help?

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Combat climate change – do open innovation methods help?

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Meanwhile a multiplicity of enterprises accepts the challenge of climate change and develops various solutions and activities to combat climate change or at least to mitigate its risks. Open innovation methods such as stakeholder dialogues, (open) innovation workshops, ideas competition, web-communities and tool-kits can enable companies to find new and sustainable solutions and activities to combat climate change.

All these methods are special practices to discuss particular and/or structural problems that (can) result from business activities with the relevant consumers or stakeholders and company representatives (1) or at least, companies can pick up new ideas to develop new climate-protecting products or services (2). The possibility to enlarge the knowledge base and to open perspectives in ad-hoc or continuous communication with consumers and stakeholders is a great advantage of open innovation methods for companies. This can open up corporate learning as well as responsible consumption. However, these open innovation methods have a different dialogue orientation and a different level of participation and therefore diverse possibilities to support combating climate change.

This study highlights the strengths and weaknesses of selected open innovation methods to combat climate change on the basis of an empirical analysis of 13 mainly German-based companies. With the help of content analysis the study analyses success factors, limits and special conditions for the realisation of climate-protecting solutions and activities generated by open innovation methods. Moreover, the limits of open innovation methods will be stressed.

42.3 Framing the role of technology in transformation of consumption practices: beyond user-product interaction

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Changes in lifestyles and behaviour patterns can contribute to climate change mitigation. Social and technical changes are however intimately related, and consumption practices entangled with technology. The ways in which products and systems are interacted with determine their actual sustainability impact. At the same time, the physical environment – the buildings, infrastructures and technologies, influence and constrain the choices of consumers and their opportunities for changing their lifestyles. Nevertheless, the traditionally perceived disconnect between behaviour and technology still seems to dominate, as when policy-makers emphasise information campaigns as means for changing behaviour and energy efficiency measures when targeting technology. There is however no one-to-one correspondence between pro-environmental attitudes and pro-environmental behaviour, and reductions in energy demand due to increased energy efficiency rarely pan out in practice. It is necessary to acknowledge that social and technical changes are intimately related, and look at the possibilities for redesigning the complex material landscapes in which individuals lead their life, in order to make more sustainable consumption practices viable. Here, the role of technology in transformation of consumption practices is in focus.

A rapidly growing branch of design research is concerned with the possibilities for using design strategically to push users towards more sustainable practices. The common denominator is the acknowledgement of design as to some extent prescribing ways of use, of design solutions as influenced by the values and considerations of their developers, and, of the actual sustainability impact of many products and systems as determined by how they are really used. Based on theories such as feedback, persuasion, constraints and affordances, scripts and critical design, and, by drawing on theory and techniques from user-centred and user-involved design disciplines like interaction design and participatory design, several strategies for design-led influence on behaviour have been identified. What is argued is that by understanding users, it is possible to use design strategically to nudge individuals towards more sustainable use patterns. Strategies include provision of feedback on the consequences of behaviour, provision of sustainable choices to empower users, 'unfreezing' of habits and encouragement of critical reflection upon practices, persuasion, steering or forcing users into sustainable use patterns, or obstruction of unsustainable use. A central variable is how much decision-making power and responsibility is delegated to the technology. Others advocate that emphasis on intangible qualities and benefits other than the environmental can strengthen the 'emotional durability' of design solutions and prevent premature replacement. The conceptual ideas abound, mostly targeting individual devices.

Design research into the possibilities for positively influencing behaviour has so far largely addressed designers' solution space and decision-making process, together with the specific strategies for individual products and systems. Little attention has been paid to the larger, highly complex picture, where many actors and structures interact and influence both technology development and the evolution of consumption practices. The role, potential and feasibility of design solutions developed to alter consumption practices must be seen in relation to the broader set of actors and power structures that are at play both in the design and the use context. For example, at the supply side, to achieve the most radical innovations and largest sustainability gains, product portfolio management and the early stages of innovation processes are recognised as critical. Such early decision-making, as well as the elaboration of design briefs and product specifications, often happens at a managerial level within the company or client, leaving designers to operational work and with little influential power. At the same time, the structural context within which commercial design practitioners operate may be said to work against rather than contribute to sustainable consumption. In companies' constant strive for new market shares, design resources are often directed at fuelling overconsumption among the affluent and creating wants and desires by constantly envisioning new products and services. Moreover, while formal design processes may be informed by use and users, they end where consumption begins. It is extensively documented that in processes of domestication, consumers appropriate technologies they bring into their private cultural spaces, giving them meaning and making (or not making) them familiar and part of routines and everyday life, in ways that may or may not have been intended by the designer. It is not possible to force actions upon individuals through well-designed artefacts. Users may ignore and even counteract the inscriptions of designers.

In order to understand under what conditions design and design-led initiatives can contribute to making consumption practices more sustainable, it is necessary to look beyond the triangle of designer, product and user. To do that, it is examined what possibilities open up by drawing on theoretical concepts that can reconnect and contribute to a better understanding of the relationships between and the influences on behaviour and technology; production and consumption. First, a brief overview of perspectives on the status of design for sustainability implementation and conditions for sustainable innovation in industry is outlined. Next, theoretical concepts and resources from the social sciences, such as distributed agency, scripts, practice theory, socio-technical systems and multi-level models of technological change are introduced and discussed in terms of their adequacy for framing further investigation into the role of design-led initiatives in transformation of consumption practices. The concept of cleanliness and the practice of laundering are chosen to illustrate the dynamics at play. Finally, the identified theoretical frameworks are applied to distinguish and further explore the relevant actors, structures and initiatives related to the current and future role of technology in the evolution and transformation of such consumption practices.

42.4 Co-design, social practices and sustainable innovation: involving users in a living lab exploratory study on bathing

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The design profession has the potential to serve ordinary people ('users') in the process of designing sustainable ways of living. This is the logic behind applying a user-centred orientation for sustainable design. One approach taken to applying such an idea has been made in an exploratory study conducted for the Living Lab project, an EU funded program to research the interactions of users with more sustainable and quality-of-life enhancing innovations. The research was motivated by a desire to understand the relation between the behaviour of end-users (users of consumer products) and sustainability, and to translate this understanding into design strategies. The chosen approach blends emerging concepts of co-design and co-creation with a 'practice-oriented' approach. The study was conducted, using bathing practices as a case topic, to explore the approach with a group of participants including users, designers and sociologists. The experience gained from the study raised new possibilities, ideas and issues for further research while advancing the approach toward a practice-oriented design methodology.

Co-design is a cooperative and continuous process bringing everyday people together with design professionals to find new and better ideas for daily life. The principles of co-design and co-creation are beginning to turn design on its head by increasingly putting the tools of design into the hands of its end-users. Co-creation appears already in emerging trends of social innovation, user-generated content, and open-source design, providing real-life examples from which the design profession is beginning to learn some valuable lessons. (Sanders & Stappers, 2008) Co-design suggests that companies offer a deliberate design role for regular people through the general idea of 'enabling platforms' (Manzini, 2007) or 'convivial tools' (Sanders, 2006) which give everyday people the capability to engage with each other in creating new concepts and designs collaboratively and to build upon existing and evolving ideas- 'mass creativity.'

The idea of a practice-oriented approach comes from a discussion happening about the conceptual and practical relevance between practice theory, studies of consumption and product design. (Julier, 2007; Shove et al, 2008; Ingram et al, 2007). The argument is that practice theory can provide a better framework for understanding issues of consumption, and this learning can be applied in design approaches in order to establish more sustainable and effective modes of consumption (including both purchase and use.) A practice-oriented approach is intended to guide the design process to look more broadly, beyond individual products and users, to the integrated routines, materials, bodies, meanings, functions, and abilities that make up everyday practices. This approach prioritizes the role of conventions, habits, and conceptions of normality in shaping resource intensive behaviours over efforts to make individual technologies or behaviours more efficient. (Shove, 2003) This is argued to be a more systemic approach that can help design for sustainability efforts to grapple with the uncertainties of consumption, such as rebound effects and user acceptance issues.

The case study on bathing brought together a group of participants to make a practical sketch of how design could enable people to make their everyday bathing practices more sustainable. Designers, sociologists and 'user' participants from the public took part in a non-hierarchical, collaborative format. Without the introduction of new designs or technologies, all participants underwent experiments in bathing, interacted using a blog site and came together for group creative sessions. The case study was organized essentially to simulate what an intentional practice-oriented design community would look like, how it would work, what members would need, and so forth.

This study is part of a general dialogue, in discussions on co-design and practice-oriented design, on the question of how users can be continuously integrated as participants the design process— of how to shorten the distance and time that separates product design and product use. A focus on the dynamics of design and use recognizes that products, people, and practices are continuously changing in response to each other. Practice-oriented design denies that finished products are necessarily the ultimate goal of the design process. Rather, products should be seen as stepping stones and building blocks for everyday people to design sustainable practices over time. Therefore, the goal of practice-oriented design is to imagine how everyday people can be cooperatively engaged in the formation of more sustainable, more effective practices, and how the design of products and services can be re-oriented toward enabling these changes.

This paper explains the hybrid approach, describes the case study on bathing, and reviews the results of the co-design process in the form of clusters of more sustainable alternative practices and products. It also discusses the learning regarding the participatory format, as well as the learning among the participants. As an exploratory study, more questions and ideas were generated for the Living Lab project to consider in future studies, which are also discussed.

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53.1 Creating Lasting Change in Energy Use Patterns through Improved User Interaction

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Europe has ambitious goals for reducing energy consumption and greenhouse gas emissions. The aim is to shift the energy market toward an increased focus on energy services based on end-user needs (e.g., light and warmth rather than electricity). Such a shift requires the adoption of radically innovative solutions entailing significant behavioural and social change. This requires a close understanding of the role of end users in technology adoption, appropriation and changing use patterns. Energy demand-side projects and the energy intermediaries operating them are key in encouraging more sustainable energy consumption patterns.

This paper is based on an ongoing EU FP7 project called CHANGING BEHAVIOUR. The project aims to support the shift toward end-user services in European energy policy. It (1) develops a sophisticated but practical model of end-user behaviour and stakeholder interaction, based on previous experience, (2) tests the conceptual model in workshops with energy practitioners in different parts of Europe (3) tests the conceptual model in pilot projects, and (4) creates a toolkit for practitioners to manage the sociotechnical change involved in energy demand side projects. CHANGING BEHAVIOUR works through intensive co-operation between researchers and energy practitioners from nine European countries.

The present paper focuses on interaction between energy users and energy practitioners. For energy experts and energy intermediaries, energy efficiency is often the most logical thing in the world. It saves money, saves the environment and reduces carbon emissions. Unfortunately, energy end-users rarely see the world in the same way. For energy end-users, energy use is often 'invisible' and rarely the subject of conscious decision. Thus, getting to know the target group and finding the best ways to interact with it are key issues for managers of energy demand-side management programmes and projects.

Background

Energy means different things to different people. Studies have found that people do not know much about how and where energy is used. While such findings suggest that more public education is necessary, they can also be criticized for exhibiting a 'deficit model' of lay knowledge concerning energy. It is assumed that because lay people do not have the same kind of knowledge as experts do, they know nothing. Other authors consider the problem of energy knowledge from the opposite perspective (Shove, 1998; Guy and Shove, 1998). Experts simply frame energy use in different terms – often ones that are distant from ordinary households' or organisations' needs and concerns. They fail to understand why households behave 'irrationally' because they fail to grasp the logic of energy use (e.g., Parnell and Popovic-Larsen, 2005). The information about user needs and the possibilities for energy efficiency is thus 'sticky' (von Hippel 1998; 2005) and does not easily move between energy users and experts.

Data and methods

The present paper draws on two sets of data, both collected within the CHANGING BEHAVIOUR project. The first is a meta-analysis of factors influencing success and failure in 24 previous cases of demand-side projects in different parts of Europe. In the present paper, we focus on an important set of factors conditioning success, i.e., interaction between the programme managers (energy experts) and the target groups (which in our cases, were households, SMEs or other building users).

The second set of data builds on our ongoing work in testing our conceptual framework in pilot projects in different parts of Europe. In our presentation, we present some of our first insights gained in trying to find improved, yet practical, ways for interacting with target groups.

Results: successful interaction in previous and ongoing projects

Our meta-analysis of success and failure in previous projects (Mourik et al. *forthcoming*) identified 'making the intervention meaningful to the target group' to be *one of the key factors* influencing the success or failure of energy demand-side programmes. Many previous attempts to influence end-users' energy consumption have failed to conceptualise energy-end users' ways of dealing with energy. One of the problems is that energy is almost a 'non-issue' in the everyday life of energy end-users: energy use is 'invisible' – a consequence of other everyday activities, rather than a conscious choice. Another problem is that previous change programmes have often failed to examine energy end-users in their social contexts. Our conceptual framework aims to provide, among others, a more realistic perspective on end-users and their contexts.

In order to make the intervention meaningful, the programme managers need to know the target group well. They need to understand why end-users use energy in a certain way, what they are doing when they use energy, how they make decisions, and what sociotechnical networks influence their energy usage patterns. Moreover, the communication channels and formats should be tailored to the specific characteristics of the user. Successful project managers also understood that end-users can have variable needs and expectations depending on their local circumstances, and often their expectations can be quite different from those of the project managers. The cases demonstrated that projects are more likely to resonate with a target group if they bring multiple benefits – e.g., increased comfort, increased sense of being in control or increased social cohesion. Successful projects came up with solutions that meet different expectations at the same time and make the project a natural way for the end-users to reach their own goals.

Larger projects can build on extensive, dedicated research on the attitudes, knowledge and practices of the target group. Small, local projects rarely have this possibility, but they may have other advantages. We found many local projects that were capable of communicating meaningfully with their target groups. We identified a number of ways in which they did so, such as close face-to-face contacts, user participation, user networks and 'mini-pilots', as well as making full use of existing research and experience within their own organizations and partners within their networks. Our presentation discusses ways of building user knowledge and user engagement into the design of energy demand-management projects on the basis of previous experiences and our ongoing pilot projects.

53.2 Co-design of products enhancing energy-responsible practices among users

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Co-design of products enhancing energy-responsible practices among users.

In the search for more sustainable consumption patterns, "behaviour change" has become a motto. A usual way to deal with this aim is the idea to change first attitudes of consumers, so that a behaviour change will follow. There is however more and more research showing that *practices* are not changing so easily, especially when consumption is inconspicuous as it is the case of household energy consumption (e.g. Shove 2003, Jackson 2005).

How to design products that may influence users towards new and more sustainable behaviours? Beyond the eco-efficiency of domestic equipments, is it possible to think them so that they suggest to their users they should be used in a thirfty way? Design generally pushes consumption and tends to be part of the problem: how to use the same design skills to make enable households behave in a more responsible way?

This paper will focus on these questions starting from the ISEU research project funded by the Belgian Science Policy . ISEU stands for "Integration of Standardisation, Ecodesign and Users in energy using products" and is a 4 years socio-technical integrated study on production and usage of energy consuming domestic appliances. It is jointly conducted by UniversitŽ Libre de Bruxelles, the Institut de Conseil et d'Etudes en DŽveloppement Durable and the Centre de Recherches et d'Information des Organisations de Consommateurs in Belgium.

Part of this research project focused precisely on a 6 months co-design session with users, conducted by Strategic Design Scenarios and ƒgŽrie Research, Belgium, in order to collaborate with families and to associate them to participative design sessions to define together with design teams, innovative design strategies and related sets of domestic appliances likely to induce energy-responsible behaviours of households. The development of the paper will focus on two main aspects of the research project: a first part will present the collaborative work with the users, the tools and interactions used to ensure their involvement in the design process. A second part will describe the results obtained at a methodological level proposing four design guidelines to favour energy-responsible behaviours and at a practical level to describe eight new concepts of products in the sectors of lighting, heating regulation, clothing care and energy smart meters.

Involving 'friendly users'

The co-design with users session has been developed during 6 months in four phases starting with online discussion with 16 families, discussing their energy consumption patterns, exchanging pictures of their living contexts and progressively building trust for the second phase of self-investigation training and ethnographic observations at their homes. The third phase has invited the families to work together with design teams at Strategic Design Scenarios offices and co-design new products concepts. Finally the fourth phase (still in progress) consists in delivering to the families, mock-ups of the products they co-designed, makes them familiarise with these new equipments in their homes, and asks them to describe why they think these new appliances are likely to improve their energy-consumption practices in front of a video camera. The short video clips of users presenting their involvement in a design process, the results they obtained and the behaviours changes they expect will feed the following of the ISEU research project, in particular to stimulate qualitative discussions with larger samples of users as well as designers and producers of domestic appliance.

The purposes of this approach will be analysed as an ideas-generation process involving users to stimulate and 'debug' designers creative thinking based on a 'casting' of 'friendly users' which involvement value is less in their testing potential rather than in their willingness to invent a supportive environment toward new and more sustainable way of living (Evans, Burns and Barrett, 2002; Snyder 2003; JŽgou 2009)

Developing design guidelines to favour energy-responsible practices.

The ISEU research project selected 4 categories of domestic appliances on which families were invited to focus on. For each of them an original interpretation of the current context emerged from the early investigations with the families, showing why according to them the current appliances proposed on the market were not facilitating a rational use of energy or worst, were favouring energy overconsumption. For each category of equipment, a new design attitude has been identified between the users and the design teams that brought, on the one hand, to a series of emblematic concepts of new products and, on the other hand, to four design guidelines to favour energy-responsible behaviours with a general value going beyond the product category they emerged from.

Processes, motivations, resulting guidelines and related concept products will be presented in detail:

- ***"Subtractive principle and lighting environment"*** allows imagination of new light switches and light distribution in the living environment to minimise the number of lights on;

- ***"Semi-manual interface principle and thermal regulation"*** reduces user cognitive overload in the fine thermal regulation following movements of people in the home while facilitating users manual regulation;

- ***"Resetting default principle and clothing care"*** allows to prompt low energy-intensive washing processes and to push evolution of users habits;

- ***"Eco-conscious artefacts and smart energy meters"*** facilitates interaction of users with energy metering enabling them to streamline household practices.

The conclusions of the specific co-design sessions within the ISEU research project gave rise to 2 levels of benefits:

- the user-centred approach starting from household activities generated very interesting results without any technological improvement of the eco-efficiency of the domestic appliances: only resetting usage patterns by a redesign of existing components 'from the shelf' shows promising solutions in streamlining energy consumption practices of households;

- the very process of the co-design sessions, the progressive training of the families, their involvement in the design of their own future environment brought us to consider all the interaction process and the material developed to be used during the sessions between users and designers as a sort of training toolkit to question people domestic practices, to take a distance from them and enable the families to re-invent progressively their daily ways of living.

53.3 User-driven Points for Feedback Motivated Electricity savings in Private Households

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ABSTRACT

This paper reports from a study of design and exploration of feedback for motivated electricity consumption to private households based on user-driven innovation. Traditionally feedback is designed on the basis of technical possibilities and/or theories on consumer behavior. In this study we present i) methods for engaging consumers in design of feedback by use of methods and techniques for evoking users innovative potential and ii) results from a user-driven process in form of design concepts and design examples for a home devise for feedback on electricity consumption. The paper starts with an introduction to the domain of electricity consumption in private households. Second, we present related work on feedback motivated electricity conservation in private households and our relation to this research field. Third, we present methods and results from our user-driven design study. In a discussion we relate our results to existing research, and are on this basis able to outline user-driven points for feedback motivated electricity savings in private households.

The study reported in the paper is part of the FEEDBACK-project: FEEDBACK motivated electricity saving in private households is a research project running from 2006-2010 involving Danish Universities (Aarhus Business School, Aalborg University, and the Danish Institute of local government studies) and business partners (software companies, hardware companies, and electricity suppliers) and households in Southern Denmark and West Denmark. The explicit goal of the project is i) to develop and test out new concepts for communication from the electrical power industry to end-users (feedback) and ii) to investigate whether on-line-feedback on electricity consumption results in energy saving. The project consists of three related sub-projects, one of which is the design of a user-interface for on-line feedback on electricity consumption. This part is based on user-driven innovation with eight families, in the spring of 2006 and managed by the authors. Prototypes providing on-line feedback on total consumption and selected devices has been implemented based on the user-driven design process and are installed in 20 households in West Denmark. A qualitative evaluation of this test are taken place in Spring 2009.

53.4 User-inspired design. User needs vs. mass customization

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The User-inspired design can be defined as the skills relates to products and services that, in different ways, take into account the psycho-physical wellness, of human beings. These products are based on a methodology on which the *User-Centred Design* approach is founded.

This approach considers the relationships and the interactions that users have with the products while they use them. This approach develops in other disciplines which are far different from the industrial design one as we know it. At the beginning of last century, the analysis of objects from a semiotic point of view spread through studies of psychology (1899) and semiology (1913-16).

In the production scenario, modern industry transforms any material into multi-use and functional objects. Later on, having overcome the absorption threshold, and considering the productive surplus, the trend will be to reconsider the objects, giving them deep and psychological meanings.

The new interpretative paradigms of contemporary create thought and action system meant to configure and strategically re-orientate productive asset that suit best the emerging model. From the previous economic model - characterized by good possession, keeping and conservation - immediacy, meant as acquisition, uses and immediate understanding of things and processes that are behind them, gains space. Actions overlap and mix.

They are realized with the purpose of boosting the satisfaction of individual needs which relates to the common ones. In this way, new planning reference begins: rational technological systems, behavior flexibility, recognizability of goods.

The research applied in order to make innovative technologies in the industrial field available, filled the human activities space with these, that link to advanced relational ideas. Ideas like the bus net, make a new type of technology and control of the installation possible. Computer and communicative system turns even more into organization needs in specific actions, allowing a degree of connection with the outside and of access to services that one could not even imagine.

By directly involving the user in the choices, with the will to understand and spot the processes between outgoing and ingoing actions in the system, you can get better results at an emotional and at a strictly functional level. The active involvement is considered with a double meaning, "educational" and "playful" (Gilmore & Pine, 2000) referring to the managerial choices of the surrounding environment. It leads to the complete modification of the role of the user, who is no longer doomed to be a passive user lacking interest in the processes and activities that surround him, which, since are largely auto-generated, fulfill or foresee the user's needs.

Moving from these thoughts, the target is focusing its attention on the use of the good by the user, so that we analyze the user' performances, rather than the product ones.

The quality of the industrial products have up to now taken into account: safety, lasting, reliability, design, and, when the product is put on the market, the right relation between price /quality.

All these quality mainly refer to the performances provided by a given product to the person who buys it. The main feature is founded on objective parameters valuable for everyone, not offering specific performances according to each and every buyer.

The characteristic taken into account in order to assure the above mentioned qualities derive from the *Human Factors* (which originally were the basis of ergonomics), that, founding on the interaction man-system, include physical, social, cognitive, organizational and environmental characteristics. Later on, considering markets saturation, consumers movements and the acquired environmental awareness, the marketing re-orients its strategies, focusing on the consumer and creating the so called silent design.

Meanwhile the consumer has changed his state; from passive buyer, the consumer becomes an active and aware user, a *silent designer*.

The use quality of a product corresponds to the interaction forms that the man creates with the product and the context in which it is. It depends on the kind and degree of relationship that the user creates with the product and the system of activities. Once the user has acquired knowledge on characteristics, ways and terms of use, he move to the following stage, the stage of the perception of the product and its wide and shared use.

The specific traits of the use quality of a product are, in first analysis, related to the performances provided, so to the ones typical of the cognitive usage: effectiveness, efficiency, satisfaction in using experience and usability perception, traits of the psychological perception.

Usability is defined by ISO regulation 9241-11, as (É) the possibility that an instrument is used by a specific user in order to meet specific targets in terms of effectiveness, efficiency, satisfaction, in a specific use context. Effectiveness means the accuracy and completeness with which the user meets specific targets. Efficacy means the resources involved in relation to the accuracy and completeness with which the user meets his or her targets. Satisfaction means a use condition which is favorable for the user and acceptable by him or her.

The *User-Centred Design* approach, a recent development of ergonomy, in relation to the area of the project, takes into account the relationships and the interactions that the users create with the products while they use them.

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54 Can Design for Sustainability change the world?

Ursula Tischner, econcept, Germany

Debaters/ visionary thinkers (to be confirmed):

Pascal Soboll, IDEO, USA and Europe

Conny Bakker, TU Delft, The Netherlands,

Cristina Rocha, INETI, Portugal

Chris Ryan, University of Melbourne, Australia

Arnold Tukker, TNO, The Netherlands

Ursula Tischner, econcept, Germany

Format: Five minutes statements of each expert, followed by podium discussion and discussion with the audience.

64 User Involvement in Sustainable Innovation

Eva Heiskanen, National Consumer Research Centre, Finland

Overview: Addressing climate change calls for radical technological and social innovations. Most of the discussion has focused on innovations developed by experts, and the role of users has gained less attention. Users can develop innovations of their own, or they can contribute to the development and acceptability of innovative solutions in co-design processes. This session proposal aims to explore different ways in which users can be involved in the development of sustainable innovations, experiences gained from user involvement, and future avenues for engaging users in sustainable innovation.

65 Future Directions of Capacity Building for Eco-design

Frank O'Connor and Simon O'Rafferty, Ecodesign Centre, Cardiff, UK

Overview: This breakout session will convene a meeting of researchers and practitioners working directly with industry in the delivery of innovation support, applied research or public funded consultancy to share knowledge and experience on current methods and models of ecodesign intervention . The objective of the workshop will be to map out current intervention models and practices, identify competency and policy gaps, identify areas of commonality, explore options for networking and knowledge transfer and suggest a common statement/platform for moving the agenda forward in Europe and in co-operation with international partners. The workshop is also open to design educators and any other stakeholders with an interest in mainstreaming ecodesign.

7.1 The politics of carbon capture and storage

James Meadowcroft, Carleton University, Ottawa, ON, Canada

This paper focuses on the politics and policy of carbon dioxide capture and storage. In particular it looks at the way societal actors have ascribed meaning to CCS, and the various ways it has figured in recent political argument. At the core of the controversy over CCS are different understandings of what CCS can represent for the transformation of contemporary energy systems towards a low carbon emission future. And the debate over these alternative understandings of CCS and visions of the energy system reflect the indeterminacy of transitions in the energy sector.

7.2 Carbon capture and storage at Vattenfall, Nordjyllandsværket

Niels Ole Knudsen, Chemistry and materials, Vattenfall A/S, Vodskov, Denmark

The European utility company Vattenfall has a strategic ambition to become CO_2-neutral in the Nordic countries in 2030 and in the rest of Europe in 2050. To achieve this ambitious goal Vattenfall will use a multitude of strategies including increased use of biomass, wind power, hydro power, nuclear energy and carbon capture and storage (CCS).

This paper will present the ongoing CCS project, at the 400 MWe coal fired combined heat and power plant Nordjyllandsværket unit 3 (NJV3). The project covers choice of site, seismic investigations, selection of technology, environmental considerations and heat integration with the district heating systems.

Simultaneously Vattenfall is planning to substitute up to 40 % of the coal used at NJV3 with biomass, - mainly wood chips. In combination with CCS this will transform the coal fired power plant into an a true CO_2 sink

7.3 Is Mineral Carbonation for CO2 storage a clean technology?

Jim Petrie, Chemical Engineering, University of Sydney, Sydney, Australia

As the world grapples with the real consequences of inaction against climate change, carbon capture and storage technologies are perceived as attractive (and necessary)[1] mitigation options for CO_2 release from fossil energy plants in the transition to a renewable energy future. However, the focus to date has been almost entirely on geo-sequestration, and there are concerns about such a technology being deployed in time, and at sufficient scale, to make a major impact on desired CO_2 reduction targets. As an alternative, mineral carbonation, the reaction of carbon dioxide with magnesium silicate minerals such as serpentines, represents a thermodynamically favourable, safe, and readily auditable route to the sequestration of carbon dioxide. But this technology is itself both energy intensive and resource intensive, and so the question to be answered here is the following:

"Are there conditions under which mineral carbonation for CO_2 storage from fossil energy generation plants can be considered a clean technology?"

Definitions of "clean technology" are generally relative. As a starting point, it is a technology which delivers gains in economic efficiency and reductions in environmental impact over competitive processes; in other words an "eco-efficient" option. Beyond this, the paradigm of "clean technology" has evolved and broadened to now sit within a sound philosophical framework of sustainability and sustainable development, to include consideration of social benefits from the deployment of such technology. The potential social impacts of climate change are catastrophic, which demands immediate, sustained, and global attention be given to the problem of atmospheric CO_2 reduction.

Given that there are no full scale commercial processes for CO_2 sequestration[2], such an evaluation is difficult. Comparative assessments are made even more difficult due to inconsistencies in spatial and temporal system boundary definitions, selective inclusion of environmental issues, and befuddlement caused by value judgments. When the impetus of action to combat climate change is added to this mix, the call is even more difficult. Whilst there have been some attempts to conduct a life cycle assessment of mineral carbonation[3], these have been based on laboratory scale information only, and are of marginal value in answering the question posed above.

As a contribution to this discussion, this paper examines a prototype full scale mineral carbonation plant, based on the Albany Research Center process[4] , which has been identified by the IPCC [5] as being most fully developed and with the greatest immediate potential for commercialization, despite anomalies identified by other researchers in the field[6]. This prototype has been developed using the ASPEN Plus modeling environment, and due consideration has been given to energy minimization, water conservation, by-product utilization, and waste management. CO_2 sequestration efficiencies in the order of 80% are achievable, under a realistic set of process development assumptions. Capital and operating costs for such a plant have been reviewed. Using a simple discounted cash flow analysis, it is possible to suggest at what price carbon dioxide emissions would need to be traded in order for such a process to be deemed "economic", in the narrowest sense.

Returning to the question, it is postulated that mineral carbonation could indeed be deemed a clean technology under the following conditions:

At the macro-scale: the technology is fully developed and deployed in short order, and at large scale, on CO_2 streams which are capture ready; to effect short term reductions in atmospheric CO_2, whilst renewable energy options are further developed

At the meso-scale: mineral carbonation should be pursued as an anchor technology within an integrated minerals-energy complex, stimulating its own industrial ecology, wherein synergistic opportunities for material and energy exchange are exploited to the mutual benefit of all partners in such a collaborative network. The added value created by such a complex has the potential to significantly off-set the direct costs and energy penalties of mineral carbonation.

At the micro-scale: process optimization for energy integration is pursued aggressively.

Ultimately, however, the potential success of this technology hinges on sustained societal pressure to combat climate change, global political will, and efficient economic instruments to stimulate carbon markets.

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[2] The Sleipner gas field project in the North Sea, which remains the world' biggest pilot, sequesters only 1 MTe/annum CO_2. A single 1000 MW_e coal fired power station generates 13-15 MTe/annum of CO_2.

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7.4 LCA as an Ecodesign Tool for Production of Electricity, Including Carbon Capture and Storage - a Study of a Gas Power Plant Case with Post-Combustion CO2 Capture at Tjeldbergodden, Norway

Cecilia A. Nyland[1], Ingunn Saur Modahl[1], Hanne Lerche Raadal[1], Olav Kårstad[2], Tore A. Torp[2] and Randi Hagemann[2], (1)Ostfold Research, Kraakeroey, Norway; (2)StatoilHydro, Trondheim, Norway

1. Introduction

Statoil has for many years worked to develop technology and processes to meet the climate challenge associated with extraction and use of fossil-based energy carriers. The debate regarding CO_2 capture, transport and storage has mainly focused on technology and economy, and a complete environmental analysis for a Norwegian case has not been available. This is why Statoil in 2007 decided to comission a Life Cycle Assessment (LCA) of a possible future Tjeldbergodden gas power plant case, including CO_2 capture, transport and storage (CCS).

The strength of an LCA is the holistic perspective from 'cradle to grave' (the analysis includes all of the activities throughout the whole value chain) and the inclusion of several environmental impact categories.

The project will give useful information regarding improvements in the design of the CCS system. The model made is now being used in an iterative process and will provide information about the environmental improvements possible with suggested improvements in design, and is thus an useful ecodesign tool for StatoilHydro's CCS system development.

Ostfold Research is a private research company in Norway, with high level competence on holistic environmental assessments. Ostfold Reseach has previously carried out life cycle inventory studies of platform-based production of oil and gas in the Norwegian sector and LCAs of gas power plants at Kårstø and Kollsnes.

2. Aim and functional unit

The aim of the study is to compare the environmental impacts of four different gas power plant scenarios and by this give input to future strategic choices in StatoilHydro. The model developed is to be the basis for scenarios and will thus be an ecodesign tool for StatoilHydro in their CCS development process.

The functional unit is 1 TWh electricity generated at Tjeldbergodden gas power plant and delivered to the grid.

3. System boundaries and project design

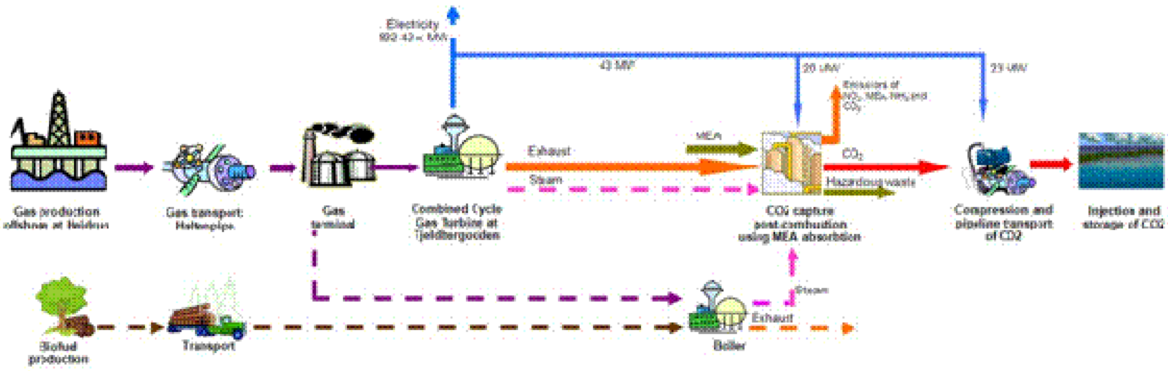
The four scenarios analysed:

· Reference Gas power plant without CCS

· CCS-1 Gas power plant with CCS, separate gas fuelled steam boiler for amine regeneration

· CCS-2 Gas power plant with CCS, separate biofuelled steam boiler for amine regeneration

· CCS-3 Gas power plant with CCS, steam from steam turbine for amine regeneration (process integration)



In these four scenarios, natural gas from the Heidrun field is used in a combined cycle process. The CO_2 capture process is based on post-combustion decarbonisation using MEA (monoethanolamine) absorbtion. After the capture process, the CO_2 is transported in a 150 km pipeline to storage at the Heidrun licence area. A simplified flowsheet of the gas power plant scenarios is shown in Figure 1.

Figure 1 Simplified flowsheet of the Tjeldbergodden gas power plant case with CO_2 capture, transport and storage (four scenarios)

The power plant is designed with two gas turbines of 262 $MW_{nominal}$ each in addition to one steam turbine of 328 $MW_{nominal}$. The nett power production will be 832 MW for the reference scenario and 789 MW for the scenarios CCS-1 and CCS-2. For scenario CCS-3 the net power will be 702 MW. The nett efficiency of the power plant is assumed to be 59.1% in the reference scenario and 44.8% in the CCS-1 scenario. It is assumed that the CO_2 capture fraction will be 90%, or 2.1 million tonnes per year. The capture facility will have emissions of CO_2, NO_2, MEA and NH_3 in addition to waste containing MEA, which is treated as hazardous waste. Construction and demolition of infrastructure such as pipelines, platform, terminal, buildings, turbines and process equipment are included in the analysis. The following environmental impact categories are included: global warming, acidification, eutrophication, photochemical ozone creation potential and cumulative potential energy demand.

4. Data sources

Design information and technical specifications for a suggested StatoilHydro power plant, capture facilities and CO_2 transport system at Tjeldbergodden have been available for this study [1, 2]. In addition, data for a future capture facility at Naturkraft's power plant at Kårstø have been used [3]. Literature data from the IEA Greenhouse Gas R&D programme and Statistics Norway have also been useful [4, 5].

5. Project status and further work

The project started in spring 2007, and in phase I, two different gas power plant scenarios were compared. In phase II, which started in September 2008, two additional scenarios will be analysed. This work will be complete in the spring 2009, enabling the authors to present details, assumptions and results at the JAOCC conference.

Preliminary results indicate that the carbon capture facility will significantly decrease the greenhouse gas emissions from the system, but that the efficiency penalty will lead to an increase in the other environmental impact categories. In addition, it is possible that airborne emissions of MEA and NH3 from the carbon capture facility will increase the potential acidification and eutrophication impacts. It is also likely that using a separate biofuelled steam boiler and steam extraction/process integration (scenarios CCS-2 and CCS-3) for amine regeneration will decrease the greenhouse gas emissions more than using a separate gas fuelled steam boiler (CCS-1).

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8.1 Quantifying the Potential and Cost-effectiveness of Industrial Symbiosis to Mitigate Greenhouse Gas Emissions

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Quantifying the Potential and Cost-effectiveness of Industrial Symbiosis to Mitigate Greenhouse Gas Emissions

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Although there is a fast growing body of literature on how and to what extent industrial symbioses (i.e. inter-firm exchange and cascading of waste materials, water and energy) affect sustainable industrial development, empirical research on their potential contributions to mitigate climate change remains very limited.

Our research aims at a systematic, quantitative assessment of the extent to which industrial symbiosis mitigate greenhouse gas (GHG) emissions in the Tianjin Economic-Technological Development Area (TEDA), one of the three national demonstration eco-industrial parks in China.

Existing symbiotic relationships to mitigate GHG emissions in TEDA can be classified into 3 categories: inter-firm energy cascading (e.g. condensate recycling, desalination), park-wide utility sharing (e.g. co-generation, carbon-black flue gas utilization), and regional waste-to-energy initiatives. The energy sources of TEDA are dominated by fossil fuels (coal, natural gas, electricity, and transportation fuels) with very limited use of geothermal and solar energy. Therefore, industrial symbiosis that may save energy significantly would substantially reduce the park-wide GHG emissions due to the carbon-intensive energy supply structure of TEDA.

Our research first quantifies the park-wide energy-related GHG emissions. Then we take stock existing energy-related symbiotic relationships and quantify their impacts on GHG emissions reduction. We further carry out a cost-effectiveness analysis of various symbiotic relationships to reduce GHG emissions at the eco-industrial park against existing intra-firm energy efficiency efforts. The research also evaluates the overall impact of industrial symbiosis on mitigating GHG emissions in comparison with the overall GHG emissions of TEDA.

The findings show energy-related symbioses at a larger geographic scale have greater potential for mitigating GHG emissions despite their higher initial capital investments. On the other hand, intra-firm energy conservation and co-located inter-firm energy cascading efforts turn out to be more cost-effective in but have smaller potential for reducing GHG emissions.

Keywords: industrial symbiosis, greenhouse gas emission, mitigation, cost-effectiveness, China

8.2 Industrial Symbiosis in Biofuel Production Industries: A Categorization of Synergies

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Conference Abstract

Industrial Symbiosis in Biofuel Production Industries: A Categorization Method for Synergies

In the production of biofuels for transportation, i.e. biodiesel, bioethanol and biogas, a vast range of unique resource flows, surpluses and by-products exist in each respective process. The current research project aims to find synergies, demands and surplus material and energy flows which will thereafter be applied to the biofuel industry and external industries in a collaborative effort to increase energy efficiencies and environmental performance through the use of synergies and industrial symbiosis. This is being conducted in order to determine conditions for implementation, why some processes and synergies exist, how the processes can be made better and to identify new material flows between industries.

During an investigation of synergies apparent in the regional biofuel industries, many synergies were discussed during a brainstorming session with industrial actors and researchers. These synergies were recorded and classified in terms of their interaction with other biofuel and external industries. Using the theories of industrial symbiosis, a classification method was developed based upon these interactions as well as the origin and destination of their resources. Previous terms from the theories of synergies research were used as background material. Thereafter symbols and classifications were based on the interactions of the synergy, i.e. between biofuel industries and external synergies. Furthermore the origins/destinations were also classified as either a product/process or as a utility but with expanded and refined boundaries.

Example: 2UP (A synergy of Class 2, i.e. biofuel to external industry synergy, which originates as a utility and is destined as a product/process for the external industry.)

Thus far the project has produced a classification scheme for biofuel synergy projects and research. Using the classification method, synergies produced at future brainstorming sessions and discussions with industry will alleviate the reproduction, recording and organization of synergies for upcoming interaction with biofuel industries worldwide.

8.3 Industrial symbiosis in the energy sector

Thomas Christensen and Tyge Kjær, Environmental, Social and Spatial Change, Roskilde University, Roskilde, Denmark

Industrial symbiosis in the energy sector

Abstract for the Joint Action on Climate Changes conference, Aalborg 9-10 June 2009

By Tyge Kjær and Thomas Budde Christensen, Roskilde University

The concept of Industrial symbiosis was during the nineties by many researchers given key role in future industrial systems. The closed energy and material loops was believed to entail a promising way in which future industrial systems could be designed so that the environmental impact from industrial operations in theory could be close to zero.

The purpose of this paper is twofold: First to explore how complex energy systems fuelled by biomass and waste materials could be optimized using the philosophy behind the industrial symbiosis concept. And second to unfold the recent development of the industrial symbiosis concept and elaborates on how it could be further developed.

Uncertain supply of fossil fuel and worries over the environmental and social effects of green house gas emissions have lead companies and public authorities to focus on how the use of biomass for energy purposes can be optimized. This paper explores how the concept of industrial symbiosis can support and optimize the utilization biomass for energy purposes. The analysis is based on a system perspective where the entire value chain is taken into consideration.

The paper is based on a research project conducted in the region of Zealand in Denmark where different types of biomass utilization was examined – all based on the concept of industrial symbiosis.

The paper concludes that energy efficiency rates for energy generation based on biomass are closely dependent on the utilization of waste streams: in a simple system the utilization of co-generated heat and in more complex systems the utilization of all waste streams. The overall system efficiency of a complex system will only reach the highest efficiency if waste streams in all links of the biomass the value chains is utilized. The paper finally concludes that future energy systems are more likely to solve the expected future fossil fuel supply problems and meet the political objectives for increased implementation of renewable energy if the present centralized energy generation system based on coal fired power plants is substituted with at distributed energy system with a high quantity of multiple renewable energy sources.

19.1 CCS: the next technological lock-in?

Philip J. Vergragt, Tellus Institute, Boston, MA, United States

Carbon Capture and Storage (CCS) is now propagated widely by policy makers, NGOs, and academics as a quick mitigation option for the large-scale curbing of greenhouse gas emissions. Its quick emergence in the last 3-4 years stands in shrill contrast with the decades-long slow emergence of renewable energy options and energy conservation. Moreover, CCS is sold as a 'bridge' or 'transitional' technology to 'buy time' for a large-scale transition to sustainable energy generating options.

In this paper we will criticize this emerging paradigm, using the Dutch (and possibly a few other countries') case as an example. CCS should rather be conceptualized as a new strategy by incumbent fossil fuel industries to consolidate their grip on the market. The concept of bridge or transitional technology is unknown in technology dynamics and innovation studies. Rather than being a 'bridge' technology, large-scale investments in CCS installations will prove to help continue the fossil fuel trajectory and hamper the development of alternatives. Its quick rise to prominence is an indicator for a renewed 'lock-in' of fossil-fuel based energy technologies.

Rather than massive large-scale investments in CCS, this paper pleads for a cautionary approach of multi-stakeholder experimentation and learning, keeping in mind that CCS should only be used where other options are not feasible, possibly in countires like India and China. Development for those markets should be a co-development together with European and US countries and companies. For the US and Europe however, CCS will hamper the quick and large-scale development of renewables, many of whom are market-ready or nearly so.

19.2 Advantages and Disadvantages of Carbon Capture and Storage as Identified by Key Stakeholders in a U.S. Context

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As a technology that may involve new risks, large-scale infrastructure, and significant government involvement, carbon capture and storage (CCS) generates considerable controversy. Because energy policy in the U.S. is negotiated at the state level, it is important to evaluate perceived advantages and disadvantages of CCS deployment in the U.S. at that level. This paper presents an analysis of CCS perceptions in 4 U.S. states representing varied levels of CCS deployment, potential for generating energy associated with CCS, and regulatory frameworks. Using a set of categories adapted from Luhmann's theory of social function systems, we present a content analysis of semi-structured interviews with key stakeholders in these states. We conclude by discussing implications of the advantages and disadvantages they identify for political contexts beyond the U.S.

19.3 CCS – a new solution or a new problem?

Palle Bendsen, NOAH Friends of The Earth Denmark, Aarhus C, Denmark

The promise of CCS is that it allows for the continued use of coal whilst at the same time contributing significantly to the necessary reduction of GHG emissions.

This presentation is set to demonstrate that CCS will most likely prove to be a problem rather than a solution. The downsides to the technology are many: firstly it will mean not only a prolongation but even an increase in the use of coal, which is linked up with serious social, health and environmental impacts. Secondly the mitigation it can render is far from what its proponents claim and a long shot from what is necessary. And thirdly the economics will most likely be poor as far as the relation between costs and mitigation effects is concerned. CCS is a 'big' technology that will most likely suffer from the same illnesses as other large projects: they end up being much more costly than promised in the 'selling phase'. On top of this is the question of liability – who will take the long-term responsibility?

Even if CCS was able to deliver a large contribution to mitigation, would it be able to do it within the necessary time frame and on the needed scale? Most sources claim that CCS at best will be developed commercially by 2020. If the world shall avoid catastrophe inducing increases in temperature then the available global carbon budget is so small that emissions must peak no later than 2015. And from there they must decline along a very steep trajectory where CCS cannot fit because its overall emissions are too large.

If succesfully sold to governments (it cannot happen without state subsidies) it will lock-in the energy supply systems with a outdated type of power generation. If CCS-systems are retrofitted to existing power plants they can take turns being obsolescent thus prolonging the coal age indefinitely. Competing with renewables for R&D resources and capital CCS will prevent an early development of sustainable energy supply systems for an energy efficient future with reduced energy demands.

The technologically developed rich countries of the world must deliver exactly that kind of future to the developing countries and to the generations to come.

The last killer-argument is CCS (partly) on biomass. But that would be a waste of a precious resource, as the biomass part of the fuel also would bear an energy penalty of 25-40%. Any biomass that can be harvested in a sustainable way should rather be used in district and even central combined heat and power generation.

20.1 Changing frames of mobility through radical policy interventions? The Stockholm congestion tax

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The introduction of a congestion tax was a significant moment in the management of mobility in Stockholm. This paper critically examines this apparent consensus on confronting car based mobility, by analysing how mobility was framed at key stages in policy making, from the 1970s through to the trial in 2006 and subsequent implementation. Changing transport objectives are compared, and winners and losers are traced in relation to motility and environmental quality. The paper argues that a car-based automobility frame survives, even in the implementation of a radical policy of congestion taxation.
At a time when the future direction of strategic management of mobility is unclear, and where serious moral and political questions exist about whether and how radical measures to control car use can or should be introduced in different settings, it becomes important to examine closely the ways in which such controversial measures surface within strategy making processes, and how they are promoted, resisted, reshaped and ultimately institutionalised or, perhaps, silenced.
The language of sustainable mobility has become widespread in policy and academic environments, but the concept remains diffuse. Recent attempts have been made to theorise a paradigm of sustainable mobility (Banister 2008). The proposed paradigm sets out four key principles for sustainable mobility, which include intervention in the regulation and pricing of transport 'so that the external costs of transport should be reflected in the actual costs of travel through higher fuel prices or through some form of road pricing' (Banister 2008, p.78-79). Citing the case of congestion charging in London, which he describes as 'the most radical transport policy that has been introduced in the UK in the last 20 years... a watershed in policy action' (Banister 2008, p.77), Banister argues that pragmatism will be necessary to implement such controversial schemes: 'A balance must be struck between the desired scheme and an acceptable scheme. The potential risk is substantial, but such choices have to be made if radical sustainable mobility polices are to be introduced at all' (Banister 2008, p.77).
This paper is motivated by the concern that even such flagship policies for urban traffic management are often ambivalent about tackling car dependence. Counter-intuitively, even policies with the strongest potential to control car use, and here we concentrate on urban congestion charging, are not necessarily designed to achieve sustainability goals, and the more radical possibilities of these interventions are often weakened during implementation (Banister, 2003).
This paper pursues this line of inquiry, focusing explicitly on the dominant frames of mobility in policy making in the city of Stockholm, Sweden, over a period of four decades. In Stockholm, the debate about how to address the problems related to private car use have continued for more than four decades, but attempts to build agreements have often failed. Therefore, the introduction of a congestion tax was a significant moment of apparent consensus in the management of mobility in Stockholm. After several decades of lobbying and political conflict, including a proposed "district charge" in the 1980s, and the Dennis Package in the early 1990s, the tax was introduced as a trial in 2006, consented to by citizens through a referendum, and then adopted permanently in the summer of 2007, to international acclaim. Except from a few remaining opponents like the chamber of commerce, there is now an apparent unity on congestion taxation as an effective measure for addressing the problems caused by the car in the city.
The aim of this paper is to critically examine the place of the car in successive framings of mobility manifested in policy schemes to deal with congestion and other traffic-related problems in the city of Stockholm since the 1970s. Focusing on policy debates on policy measures for congestion reduction, we explore how the different frames of mobility opened up new possibilities for action in this complex urban governance setting. Central to the analysis is the question of how actors sought to make the difficult choices and trade-offs implicit in seeking to manage urban mobility. We reflect on the potential

consequences of different framings in terms of the associated patterns of mobility, motility and environmental qualities. Thus what is in focus is how the framing of personal mobility by the private car shifted in successive dominant frames. We also seek to show how particular power relations, at different times, played a part in the production of each frame. Overall, we attempt to trace how the successive debates over congestion taxation managed difficult questions about future urban mobility, and how the role of the car was treated in this.

The paper sets out an approach for analysing frames of mobility. This is followed by presentation of the results of the analysis of frames of mobility, from early political debates about how to control access by car to the city of Stockholm in the 1970s and 1980s, to the Dennis Package in the 1990s, the congestion tax trial in 2006 and the adopted congestion tax scheme in 2007. This leads to a concluding discussion of how controversial and contested aspects of urban mobility, in particular the role of the private car, were managed over time.

20.2 Sustainable Campus Commuting Management at Aalborg University

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Sustainable Campus Commuting Management at Aalborg University

Keywords

Greenhouse-gas Accounting, Environmental Management, Public-Private Partnership, Aalborg, Development of environmental reporting, Car-pooling; mobility mapping, mobility management, commuter planning.

Introduction

One of the major environmental impacts relating to university activities is transportation, both as regards work-related travel tied with conference trips, etc. as well as daily commuting to and from the university. At Aalborg University we have examined this problem complex from various perspectives. Among others, an environmental Input/Output assessment has been carried out on university-related activities based on purchasing information, and it is clear from this assessment, and the University Green Account, that measured in terms of contribution to climate change, transportation is one of the major contributing activities. What is not counted for in the assessment, however, is the daily work-related transportation patterns to and from the university, also called commuting. The natural reason that commuting hitherto has not been included in the environmental assessment of the university's activities is that this transportation is not captured in the university's direct purchases. For the same reason, commuting is not included as an obligatory component in the standard accounting methods for greenhouse gas emission accounting (see e.g. ISO 14064-1, BS-PAS 2050), but rather as an optional indirect Scope 3 emission that most often is not accounted for.

Most existing assessments of commuting in relation to other university sites focus on transport patterns among students and with special attention to the bicycling (see e.g. Conway et al. 2008, Christie 2007, Knuth et al. 2007, Lemos et al. 2006, Tolley 1996).

In the paper we discuss how Aalborg University and surrounding actors, not least Aalborg Municipality, can take supportive action and structural responsibility for transport-related emissions. The core of the paper is the presentation of a quantitative assessment of transportation patterns and related emissions, assessments that ultimately can be used to reduce these contributions at both the university level, e.g. within the scope of campus environmental management activities, as well as actions falling within the domain of Aalborg Municipality in partnership with the university. This assessment gives the empirical basis to discuss a number of possible interpretations of the current private (non-business) mobility patterns, and thereby point at possibilities for reducing the environmental impact originating from commuting transport in a constructive and co-operative manner.

The range of objectives focus on reduced emissions from transport and include advancing bicycle transport, increasing the use of public transportation, car-pooling, working from home, and transport-reducing ICT's. Possible means for achieving this may include altered parking-payment systems, enhanced services and infrastructure for non-motorized transportation, an accommodated public transportation structure, planning of students' accommodation improved facilities for working form home, etc.

The Survey

The survey is structured as a combined web-based and physical questionnaire (due to some technical-administrative employee groupings not having access to emailing services), and is targeted at all employees and students related to an Aalborg University campus (there are three campus areas in Aalborg, Esbjerg and Copenhagen respectively, of which Aalborg is the biggest with several addresses). However, the solutions-oriented discussionwill focus on the Aalborg campuses, and will have less focus on campus in Esbjerg and Copenhagen as it is in Aalborg that the university has the best potential for collaborating with public authorities on the issue. The survey is designed is to support the following central questions:

Background information: Knowledge of types of households, income, affiliation with Aalborg University, distance to work (study) are central questions.

Volume of commuting transport: A central purpose of the survey is to establish an estimate of commuting-related emissions of greenhouse gasses (GHGs) and here the transport distance together with mode of transport are the key figures.

Categories of transport distances: In an anonymised form, the data will form the basis for a quantitative description of transport patterns, which is an important precondition for the development of strategies to improve performance.

Use and availability of cars for commuting purposes.

Transport and working/studying practice: The knowledge of modes of transport partly feed into the GHG assessment, and the actual practises form the prime basis for assessing potentials and barriers for improving the environmental performance related to commuting transport related to Aalborg University.

Normative attitudes towards transportation: This part of the questionnaire focuses on the normative preferences and rationales in transportation choices, and supports the analysis of potentials and barriers for improving the environmental performance related to commuting transport.

The Assessment

The paper concludes with a discussion of the findings of the survey. A central issue is how commuting activities can be integrated into or related to an environmental management system that is on its way to become established at Aalborg University. Furthermore, it is discussed how initiatives to improve performance can be accomplished from a governance perspective, including public-private partnerships. Finally the discussion will include how participatory processes can be included to reach solutions that both are sustainable and workable.

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20.3 Freight transports and the Market Challenges for Achieving Sustainable Mobility

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Despite the current recession in Europe, the demand for freight transports is very strong. The transport sector has become a heavier polluter of the environment in the last two decades due to increased freight transports, especially on road. In Europe, the growth rate is particularly strong regarding freight transports on road, while rail transports are still on a stable, low level (European Communities 2003). This implies direct environmental, negative effects (e.g. increased congestion, emissions of air polluters and accidents), but also indirect effects of carbon dioxide, in terms of global warming. The European Union has stated that continued growth in traffic is not compatible with sustainable development and that the transport sector must decrease emissions of green house gases. There are also several practices causing "excessive" freight truck traffic (e.g. empty running or sub-optimal modal choice), where the most obvious way of minimizing this excessive use is to apply the "Polluter Pays Principle" and internalize its social and environmental cost (McKinnon 1994). This is also discussed among policy makers in the European Union.

There are several challenges how steer the transport pattern into a more sustainable one. The policy side is one thing but at the same time, there are various initiatives and forces on the demand side that should stimulate the market of transport services. The increasing demand for more sustainable freight transports among transport-buying companies, in Sweden but also in other European countries, is a reality for many logistics service providers today. The transport providers are in a situation where certain groups of customers, especially large manufacturing companies (Lammgard, 2007), have a shift in their demand, but at the same time there is an uncertainty among the transport providers of this should affect their products and services sold as the willingness to pay of the customers are highly uncertain. The transport sector is a highly competitive one where the competition on prices is keen. The transport providers now struggle with the challenge of meeting this demand.

There have been various studies studying how the logistics managers in transport buying companies evaluate different aspects when transports are bought. It is not only a transport service to be sold but a function, where the core service is to transport freight from point A to point B in the right time. However, there are other service quality aspects of interest, and among these can the environmental aspects of the transports be positioned. The buying of logistical services are dealt with in classic logistics literature (e.g. Bowersox and Closs 1996; Christopher 1992) but do not normally include the environmental considerations. If environmental aspects are mentioned, it is in the context of reverse logistics, life-cycle assessments, or safety. In reality, environmental concerns are taken into account when freight transports are purchased to a various extent, at least in Sweden where there have been a few Swedish studies (Björklund 2005; Laitila and Westin 2001, Lammgård 2007). One practice established is e.g. the use of environmental evaluation forms (NTM 2005).

This paper examines the existing literature and studies in the fields of logistics and transportation with regards to environmental aspects. The purpose is to identify the challenges facing the transport providers based on changes in the demand concerning environmental aspects, but also the opportunities for these transport providers that are proactive. The policy area is not in focus in this paper, rather a market-driven view of how the market forces can be used in attaining a more sustainable freight transport sector. The experience of research within this area since 2001 will be used in this analysis.

21.1 Climate Communities - a springboard to explore climate action at the local level

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While governments fail to commit into binding goals for climate action, local initiatives are blossoming regionally and especially at the community level in Denmark. The Danish Society for Nature Conservation - the largest E-NGO in Denmark - has developed a simple, yet effective, concept with inspiration from the US Cool Cities campaign. Climate Communities are now signed up by almost <half> of the Danish municipalities, all committing into a goal of at least 2% CO_2-reduction per year. Thus instead of waiting for long term goals, e.g. CO_2 neutral in 2050, Climate Communities start today, delivering results next year. The campaign is supported by a number of other activities: Local Climate Summits in ten municipalities, where local politicians meet other local decision makers for a one day brainstorm om climate solutions; The Copenhagen Climate Exchange 2009, a global exhibition and fair, where cities, organisations and innovative enterprises from across the world meet and share ideas on how to solve the climate crisis. Climate Communities also join forces with the Ministry of Climate and Energy on Energy Cities and with The Danish Electricity Saving Trust on various activities.

21.2 Sustainability transitions, globalization and regionalization

Udo Pesch, Technology, Policy & Management, Delft University of Technology, Delft, Netherlands

To solve sustainability problems, especially those related to energy, huge socio-technical innovations have to take place. Theory that is developed on how stimulate such innovations by stressing the interplay between knowledge and technology development, policy and entrepreneurship features some interesting points of departure.

However, in spite of the promising aspects these theoretical frameworks, there are still some fundamental theoretical and practical barriers to overcome. This paper addresses some of these barriers and explores a route to avoid at least some of these problems. It does so by focusing on the connections between sustainability socio-technical transitions, globalization and regionalization. This connection shows some potential for a theoretical and practical framework that allows an effective approach to sustainability problems.

An insight that is commonly held is that in order to achieve a sustainable society, it necessary to have so-called socio-technical transitions, in which the notion of 'transitions' refers to interconnected fundamental changes in society and technology. To conceptualize such transitions, authors have introduced a range of approaches of which most are *systemic* approaches. For instance, socio-technical systems, socio-technical innovations systems, social-ecological systems.

The benefit of these systemic approaches lies in their articulation of the complex character of radical socio-technical changes, which are based on the interplay of systemic elements, such as actors, institutions, technologies, etc. This complexity implies that future socio-technical developments are fundamentally unpredictable. However, by identifying the elements that prevent or stimulate innovative trajectories, these systemic approaches allow beneficial strategies to be constructed. One may think here of strategies like the stimulation of the interaction between actors and the strengthening of the interdependencies between systemic elements. In that way, resources, people and ideas are brought together so that common orientations can be established.

A crucial question, however, concerns the boundaries of the system. In most cases, researchers make an identification of their system with a national state. The logic of this choice is obvious, as national states convey a unified body of laws, policies, institutions and values. However, it is also obvious that not every socio-technical systemic element fits well within this national scope. Technology, science and market economy for instance have an increasing tendency to become internationally orientated. Nowadays, also politics and culture do not simply coincide with national arrangements. In other terms, the development of globalization is puts a large strain upon the way socio-technical systems are identified.

The significance of this problem increases if we focus on socio-technical transitions. First, because these address long-term developments and the development of globalization can only be expected to become more intense in the coming decades. Although it may not be so that national boundaries will become irrelevant, it seems evident that economic, social and institutional conditions will relate differently to national boundaries in the future. Globalization implies the nature of national boundaries will change substantially. Second, dealing with sustainability we are looking at a globalised issue throughout, as it encompasses global environmental and global socio-economical problems.

What can be done about this problem? The scope of a socio-technical systems approach cannot be enlarged without losing relevance, because territorial expansion of a systemic approach leads to management problems in relation to the interactions between individual actors and also to methodological problems, because of the sheer size of the empirical domain that has to be covered. This paper suggests that a possible way out may lie in perceiving 'regionalization' as a development that has emerged simultaneously with globalization. It can even be so that regionalization and globalization are two sides of one medal.

Clearly, regionalization is not described as exhaustively as globalization. Still, one can observe an increased significance of regional and local factors – be it in different and perhaps unconnected spheres. Here, some phenomena will be presented that are involved in this process. In relation to concrete politics, we can think for instance about the attempts of many local and regional authorities to develop sustainability plans that go beyond national or international requirement. Such local and regional authorities seem to be much more effective in involving citizens and companies in environmental issues. Another salient development is the development of 'industrial ecology', which includes both academic and entrepreneurial efforts to find sustainable synergies between different industrial activities. Turning towards scholarly activities, one can witness a growing body of literature on stakeholder involvement and knowledge issues, in which the relevance of local knowledge is emphasized.

This provisional list of examples is by no means complete. Nevertheless, it allows one to make some inferences about particular trends. Both in theory and in practice, the effectiveness of local governance arrangements is perceived to be greater, allowing for concrete decisions, which concern consensus on goals, the stimulation of entrepreneurial and industrial activities, the concentration of stakeholders, etc. Also, the contribution of local actors is taken more seriously; their reasoning is not instantly equated with their particular interest. At the same time, individual citizens demand to be taken more seriously, which can be related to the way the general public has emancipated over the last decades. The general level of education has increased immensely during the last generations, which implies that capabilities to find and process information has also increased – helped by developments in communication technologies.

Above, we have observed three developments in a rather tentative manner. First, the appropriate territorial scale of socio-technical systemic approaches has been introduced as a problem question for thinking about sustainability transitions. Second, the long term effects of globalization on national boundaries in relation to sustainability issues needs to be identified. Third, the connections of globalization and 'regionalization' need to be mapped out.

These three developments, which are here linked to each other, lead into distinct research questions – involving insights from sociology, technology dynamics, environmental studies. Until now, there has not been much research activities that deal with these issues in this particular context. The potential of a theoretical framework that combines these issues seems quite large, therefore this paper hopes to help in the development of such a framework.

21.3 The City of Short Distances - a new model for sustainable urban development

Chris Ryan, The Victorian Eco-Innovation Lab, University of Melbourne, Melbourne, Australia

Responding to climate change requires much more than the redesign of existing goods and services. We need new systems of 'low-carbon' production and consumption with new infrastructure and new patterns of living that are resilient, robust under climate induced challenges. What does this mean for the processes of urban design and (re)development?

A project initiated in Melbourne in 2007, a collaboration between four universities and hundreds of professionals, has set out to revision the fundamental structures of the city based around a paradigm switch to distributed systems and the re-localisation of production and consumption. Melbourne in twenty-five years time is conceived as a 'city of short distances', describing relationships of mobility as well as the production and consumption of life-critical resources – energy, water and food. This vision has been used to engage with processes of local transition and transformation for existing communities as well as for the design of new 'eco-city' developments. All these projects aim to change expectations about the 'trajectories of development'. In this process the terms 'distributed systems' and 'short distances' rather than decentralisation because the 're-localisation' of production and consumption takes place within networks of interdependence at larger scales – regional, national, global. The concept, process and outcomes of these projects will be described and compared to other established programs which aim to transition communities and cities to a sustainable form.

21.4 Sustainable Communities.

Woodrow Clark II, Clark Strategic Partners, US

Text Not Available.

32.1 *Electric vehicles are here to stay! The role of design as interface between user and technology*

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Electric vehicle motor has past of nearly 160 years. Electric vehicles (EV) were never matured when compared to internal combustion engines. EVs were always there but in their own limited capacity. Issues such as insufficient infrastructure and lack of support from auto industry delayed the EV for too long. The present situation of congestion and emissions presses the need for clean vehicles and use of alternative energy sources. There are different competitors come along the way such as bio based fuels and hydrogen. Still EVs and plug-in hybrids are seen as promising solutions for near future. This is the time to say that EVs are here to stay and this paper gives examples to illustrate the role of design to do so. The EVs have its own advantages and disadvantages. The aspects such as power and range of EVs are still in development. In mean time it is a best solution for congested urban areas which is efficient in energy usage and local emission free. In comparison to state of the art systems of transportation, EVs can use their advantages to come up with new ownerships and advanced infrastructures. In these kinds of settings special purpose vehicles niche vehicles could play an important role to lead mobility into service based sustainable system. This paper tries to explore the ways in which design can play as an interface between consumer and technology. And also focuses on how different niche vehicles and portable solutions can play a role in stimulating the use of EVs.

32.2 Advent of electric vehicles: towards a research agenda

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If one believes the buzz of all electric vehicle introductions and promises coming out of industry and different auto shows, one would think we are a year or two away from electric paradise, and a significant step towards energy independence. The reality is we are not even close. But its time to develop electric vehicles which consumers can afford and want to use. This is a challenge not only to auto industry but to all different stakeholders who want to promote or develop electric vehicles.

The purpose of this paper is twofold. First to report on the developments in electrical vehicles and electrical mobility, with a particular focus on the Netherlands where utilities have taken the lead in a transition to a grid-based sustainable electrical mobility. The paper includes technology and knowledge developments, product and market developments, industry dynamics, government initiatives, as well as social and user aspects. It includes an evaluation of barriers and benefits of a transition towards sustainable electric mobility in the Netherlands.

Second, the paper tries to give an attempt in order to stimulate and facilitate electric vehicle introductions. It proposes research agenda deals with identified barriers as well as with achieving the benefits of sustainable electric mobility and focuses on aspects, such as creating a network and information exchange point for policy makers, entrepreneurs, scientists and a broader public. It also aims at bringing different activities together and to create synergy in order to make a strong case for electric vehicles and interest the auto industry towards electric vehicles. Another focus is to demonstrate the latest developments and make a business case that appeals consumer. Another question is what aspects need to be demonstrated during these demonstrations. The Dutch INCERT program and project Better-place are given as examples to illustrate initiatives in the Netherlands and international level.

32.3 The bike is back with a battery

Frank van Der Hoeven, Architecture, Delft University of Technology, Delft, Netherlands

The attention the electric car receive as a promising means of sustainable transportation is justified but seem to overshadow the rise of that other electric vehicle: the pedelec or electric-bike. For those who don't know yet: a pedelec is a bicycle assisted by an electric motor. The motor powered by a rechargeable (lithium-ion) battery. The motor is intended to assist pedaling, not to replace it. The motor multiplies someone's muscle power. In legal terms a pedelec is a regular bicycle as long as the motor's power doesn't exceed 250W and the maximum speed is leveled off to a 25 km/h. High speed pedelecs with a maximum speed of 35 km/h do exist but are legally regarded as mopeds. The most interesting aspect from a pedelec is that it is a much improved bicycle. Elderly can cycle till a older age. People living in cities or rural areas with steep height differences will benefit from pedelecs. Pedelecs allow you to bridge longer distances. And people will not sweat, which is a major issue with trips between home and the office. Pedelecs do not simply replace regular bicycles. They will change the way bicycles are used and have a significant impact in the way people move around on two wheels. In 2008 almost 120.000 pedelecs were sold in The Netherlands. This number grew from 22.000 in 2004, 34.000 in 2005, 44.000 in 2006 and 89.000 in 2007. Although pedelecs still represent a small percentage in the actual number of bikes being sold, due to their high price tag they already account for a third of the turnover in bicycles sales. This makes it very lucrative to market this specific vehicle. This paper assumes that the growing use of pedelecs requires a different approach from transport and urban planning towards two wheelers. It will outline the major differences between regular bike use and pedelec use and addresses issues like parking and charging. It will also discuss how the rise of pedelecs may function as a stepping stone for sustainable electric car mobility.

32.4 Backcasting for sustainable mobility and domestic power provision: a new perspective on fuel cell vehicles for decentralised power production

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Hydrogen is an important topic in the transition towards sustainable energy supply as well as in the transition towards sustainable mobility. However, these transitions are seldom considered together. In this paper we argue that a technical and institutional integration around grid-connected electric vehicles could lead to considerable synergy and efficiency improvements, as well as increased potential for achieving sustainability goals. The key to the integrated perspective is that the present utilization of car power-trains is on average possibly only about 5%. This implies that in effect 95% of the time these high-tech products are standing idle at a parking lot. This highly inefficient use of capital investments in a high-tech product in a offers of large potential for improvement in various ways.

With the renewed interest for the electric vehicle in its various forms like battery electric vehicles (BEV), (hydrogen-driven) fuel cell vehicles (FCV) and various types of hybrid propulsion, the potential role of this technology in the energy transition and possibly a very radical innovation becomes opportune. Connecting all 6 million cars in the Netherlands (assumed to the fuel cell vehicles) to the grid, for example, provides a total generation capacity of about 240 GW, i.e. more than 10 times the installed present electric power production capacity.

The starting points above have been used for developing two future visions that served as an input to a backcasting analysis. In the first vision A FCV's are used to provide power during peak hours and to store surplus power from large-scale renewable energy sources by using a reversible fuel cell. The fuel cell can charge the hydrogen storage devices on board the FCV's, but hydrogen is also provided by fuel stations. In the second vision B the power delivered to the grid by the grid-connected FCV's will fully meet the electricity demand, making central power plants obsolete.

The paper discusses and analyses both visions, before it deals with required changes, various implications and recommendations how to address further possibilities to explore research, social and policy issues, using the Netherlands as a case. The paper also discusses current developments with regard to plug-in vehicles, focusing in particular on developments in FCV's. It also introduces the backcasting approach and how it has been applied in the backcasting study reported on.

33.1 Energy City Frederikshavn: Activists and Power

Maria Ussing Larsen, Urban Planning and Management, Aalborg University, Aalborg, Denmark

The climatic changes have inspired experts to make incentives to initiate locally to reduce CO_2 emissions and thereby prevent climate change. An example of such an initiative is the Energy City Frederikshavn. The goal is to have 100 percent renewable energy in 2015. The goal should be achieved by technical solutions in the municipality, but also by involving the citizens. The Energy City has made an Energy City Activist Group as a public participation project. This public participation project wants to work with and realise the ideas of the activists. The power in the activist group is investigated through "the seven ways of power" by Haugaard (2003). Public participation aspects by Arnstein (1969) are also investigated. The seven ways of power can be found in different ways in and around the activists, and the intention is to share the power between the organisers and the activists, but it has not come into force jet, because they are in the middle of the process. The powerholders are the Energy City, but their attitude towards the activists is currently diffuse and it makes power distribution inefficient.

33.2 Climate change action plans for municipalities

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Climate change action plans for municipalities
- Case study of urban development and mitigation

The paper recognizes that climate change requires a strong public sector responsibility and public actions, and that local authorities play a vital role in both adaptation and mitigation strategies. The aim of the paper is to present and discuss:
- A model for local level climate change action planning.
- A case study with climate change action plan from Copenhagen Municipality focusing on linkages between urban development and climate change mitigation.

Climate change action planning

Climate change challenges the local environments and municipalities on two fronts:
1. Mitigation of further climate changes through reduction of green house gases from municipal activities and geography and
2. Adaptation to climate change, like extreme weather events including storms, erosions and flooding.

The two principal ways of responding to climate change require action in local level planning and can be included in a municipal climate change action plan.
The third leg in climate planning is the process including e.g. public participation, partnerships, coordination between climate change action plan and additional planning plus the implementation of the actions. A climate change action plan will be measured by its effect, and the ownership of key actors is thereby essential to the success. In the planning process the municipality can choose to involve organizations and citizens while the effort at the same time is embedded in the municipal organization. The plan needs to have a proactive and profitable interface with other plans like e.g. urban spatial plan, environmental plans and other sector plans within energy, water and nature.

The climate change action plan is a new interdisciplinary type of plan. The point of departure is a programming of the task in which outlining of objectives and economies are key features. Setting up a model for CO_2 calculations is a starting point for the mitigating action planning, while risk assessment is the starting point for the adaptation strategy. Instruments are the backbone in the plan and involve both green house gas reduction and climate change adaptation.

Case study: Urban development and climate change mitigation

The case study presented is based upon the work done by COWI A/S for Copenhagen Municipality in relation to 'The Copenhagen Municipality Climate Plan 2015'. Copenhagen wants to take on the leadership of reducing green house gas emissions. The political objective is a minimum absolute reduction of 20 % in 2015 compared with 2005. The plan is expected to be political adapted before the summer 2009. The paper presents and discusses some of the results from one of the developed instrument catalogues. The catalogue considers urban development and how urban planning can support a climate friendly behavior. The instrument catalogue is one of other catalogues including other areas like transport, energy supply, buildings, behavior and adaptation.

Urban development and urban growth is a contributor to CO_2 emissions and at the same time an essential factor for obtaining CO_2 reductions and thereby contribute to solving the climate challenge. Central to mitigation is an urban development based upon compact development, mixed land use and appropriate localization of functions. Such an urban development causes: Reduction in energy demand for heating and cooling in buildings, shorter transport distances, reduced commuting by car, reduction in waste cycles and reduction in municipal infrastructure (water, electricity etc.).

Building upon existing research on the relationship between urban development, transport and energy use the paper presents the results from calculating CO_2 emissions related to different mitigating instruments. It is concluded that planning of buildings and infrastructure plays a pivotal role for Copenhagen Municipality in obtaining reduction of CO_2 emissions - especially securing an urban development affecting transport patterns and choice of transport means with reduced car use, increased cycling and public transport. Besides CO_2 emissions economic consequences of implementing the assessed mitigation instruments will be presented and discussed.

33.3 Climate and eco-adaptation in housing and construction -regional transition strategies

Jesper Holm, Inger Stauning and Bent Søndergård, Enspac, Roskilde University, Roskilde, Denmark

Climate and eco-adaptation in housing and construction – regional transition strategies

Jesper Holm, Inger Stauning, Bent Søndergård, ENSPAC, RUC

The paper examines in a Danish context the role of municipalities and regions in contributing to climate- and eco-transition of housing and construction, by examining recent programs and policies for transforming housing practices and technologies. It is based on studies of innovative projects and municipality practices/policies conducted in the research project KIBS (*Klimatilpasset Innovation i Byggeriet i region Sjælland*, [Climate adapted innovation in construction in Region Zeeland]) [1]

Transition of housing and construction sectors plays a vital role in societies' adaptation to climate and ecological challenges. In Denmark, 40% of energy consumption is related to housing. This, combined with the fact that construction and retrofitting of buildings involves a substantial resource drain, high volume of waste and use of a high amount of chemicals, has since the 1970xs led to various efforts to redefine housing and construction technologies and practices.

Progress, however, has been slow. For a decade the Danish construction industry has benefited from a booming construction market leaving few incentives to adopt new technologies and practices. The economic crisis and climate agenda changes this situation; low energy and passive houses and energy retrofitting of residential and public buildings are identified as new necessities and markets. Construction and housing is currently being enrolled into (national/EU) programs of climate adaptation, implying also a systemic perspective on housing and construction, where change of energy performance of houses is seen as a part of an overall transition to low carbon energy systems. With no Danish state-driven lead market efforts on sustainable construction and housing, municipalities and regional authorities are sought for as main actors in spurring a development path, and in the stipulated development they will be ascribed new roles and obligations to drive and support climate and eco-adaptation. On a national scale, we have experienced a wide array of municipality strategies and programs on climate and eco-adaptation of housing and construction, ranging from Local agenda 21 programs of public involvement, public-private partnerships and local climate/CO_2 reduction programs.

The analytic approach in the paper is a perception of construction and housing sector as socio-technical systems (Geels, Bergek/Jacobsson) where transition is understood as changes in technologies, actors, network and institutional frameworks, and as interplay of socio-technical regimes and socio-technical experiments and niches. The construction and housing sector in particular is characterised by high complexity; a transition to new technology paths involves a concurrent and distributed change of technologies, actors, competences and perceptions, both in relation to production chains and project processes. However, processes of transition can be seen as localised, taking place in specific local settings, which can be influenced and co-shaped by local/regional policies and programs. In the analysis, we look for how local policies, embedded in institutional frameworks and business sectors, shape local innovative housing and construction projects (socio-technical experimentation). We also want to know whether and how these projects and innovations are disseminated.

The analysis of projects and socio-technical experiments in Region Zeeland reveals a high differentiation in local approaches to the development of the local housing sector and construction, depending on perceptions of the challenges and on specific local conditions. Within the region there have been few cases of socio-technical experiments and project within construction, however, they have served as important showcases and situated learning. They have demonstrated on the one hand the feasibility of low energy dwellings, combining environmental and comfort demands, and on the other hand exposing potentials and limitations of institutional framework and instruments available to municipalities in their planning.

Two types of projects/socio-technical experimentation can be identified where local municipalities play a role: those driven by social entrepreneurship (e.g. self constructors, eco-villages) and those driven by progressive institutional actors (municipalities, cooperative housing societies, ...). In both cases, a main problem has been lack of diffusion, as the established housing sector and construction industry have related hesitant to innovations and knowledge from the projects. Adoption has taken place, but in processes of interpretation and selection only incremental changes within dominant technology paths and practices have occurred.

The perceived radical redefinition of roles and opportunities of regions and municipalities is yet to materialise, as main picture is currently a continuation of a market based approach leaving few new options for municipalities (and other institutional actors, such as cooperative housing societies) to shape and support a transition of the housing sector and construction industry. Opposed to this approach, a transition perspective is asserted. Based on the analyses of experiences of projects/socio-technical experimentations and the range of municipality strategies and programs and based on the understanding of transition processes, the final part of the paper discusses how a transition program can be outlines and how local programs and policies of regions and municipalities may shape and support local transition.

The structure of the paper:

· Setting the Danish stage. Short presentation of the development of the Danish construction industry and housing sector in relation to challenges of climate/energy and environment. Focus is on policies and regulation implemented to support energy and eco-innovation in housing and construction, and in particular on the development of institutional frameworks and instruments available to municipalities and regions

· The theoretical framework – how can we understand the role of local actors in transition of socio-technical systems?

· Analysis of local projects and socio-technical experimentations within the Danish construction and housing sector. The projects are analysed with the perspective to examine the interplay of the projects with practices and policies of municipalities and with the existing institutional framework and production structure. The aim is to identify options and best practices and to identify structural and institutional barriers.

· Discussion of regional and local strategies and programs in a transition perspective; how can regions and municipalities shape and support transition of local housing sector and construction industry.

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[1] The project was funded 2007/8 by Region Zeeland. The project was a co-operation with partners from The Danish Building Research Institute, Technical University of Denmark and Danish technological Institute.

33.4 Developing a CO2-Management System for Public Authorities

Edeltraud Guenther, Julia Friedemann and Kristin Stechemesser, Faculty of Business and Economics, Chair of Environmental Management and Accounting, Technische Universitaet Dresden/ Technical University Dresden, Dresden, Germany

The research project targets on conceptualizing a steering tool suitable for reducing energy consumption and CO_2-emissions in Dresden, an average-sized city in Germany. The concept was developed in 2007/2008. Since each city, intending to reduce CO_2-emissions, needs to find its own suitable instruments and measures. Over the last few years, the public awareness of climate change and its expected effects have risen dramatically. With this in mind, it is not surprising, that climate change has become an important topic for decision makers in politics, too. Here, local governments play an important role in reducing greenhouse gas emissions, which they increasingly fill. Evidence for that surely gives the growing number of cities and communities engaged in climate initiatives like the climate alliance or C40[1]. But not only the rising public awareness leads to a rising interest of local governments in climate protection, also rising costs for energy let many politicians realize the importance of reducing energy consumption and thereby CO_2-emissions.
To ascertain the different existing instruments for steering energy management and hence CO_2-Managment we did a literature search in the professional databases wiso wissenschaften[2], ebsco host, elsevier science, ULIDAT and UFORDAT[3], library and literature catalogue of Sächsische Landesbibliothek Dresden. The literature search focuses on three aims. First, describing of applicable steering instruments that can reduce energy consumption in a public administration. Secondly, characterizing the steering instruments by relevant strengths and weaknesses so that decision makers can take the right decision. Applied examples from municipalities and companies are the third aim. Furthermore we had to consider that reductions in CO_2-emissions can be achieved in different fields of actions, including for example: traffic, energy consumption, public procurement, construction and redevelopment as well as local town planning or maintenance and housekeeping of public real estates. Since it would be rather misleading to intend to address all possible fields of actions at the same time, it first should be evaluated, which field of action has not been targeted so far or seems to be the most promising considering the attainable CO_2-reductions and existing preconditions for each case. Therefore three fields of actions have been chosen beforehand. Firstly, the *energy consumption patterns* of the employees as the users of the public buildings, thus the user behaviour should be targeted. Secondly, the procurement of *office equipment and IT* was included, since they already contribute to as much as 40% of the energy consumption in a modern office unit (Radgen 1999: 1 or Berliner Energieagentur 2007: 5). Thirdly, investment decisions made in order to *(re)build or modernize public buildings and technical equipment* e. g. for heating or air-conditioning are considered. Here, the long life-span of the concerned machinery and constructions determines the future energy consumption for quite some time, making it very important to carefully consider every single possibility to save energy.
After collecting theoretical concepts we looked for appropriate practical examples. The chosen examples are innovative and successful because they score well in inter-municipal competitions like "Climate Star", "Federal capital in climate protection", "European Energy Trophy". Additionally we had selected good-practice-examples and case studies that are published in connection with different relevant projects e.g. managEnergy, GreenLabelsPurchase, Procura+.
At all we present 35 steering instruments whereas 13 of them are instruments of the strategic level and 22 of them are instruments that focus on the fields of action that have chosen before. In detail we identified 6 instruments that target on user behaviour. Respectively 8 instruments tend to procurement and investment decisions. Table 1 represent all steering instruments. As mentioned above for every instrument we elucidate the instrument itself and how you can adopt it for energy saving issues, its strengths and weaknesses. Furthermore we demonstrate different practical examples.
Table 1: Steering instruments for a CO_2-Management system for public authorities

Strategic instruments	Instruments with focus on user behaviour	Instruments with focus on procurement	Instruments with focus on investment decisions
Overall concept, strategic objectives, key figures	Competition	Educational projects/ Information campaigns	Energy guidelines
Formation/ creation and description of (sustainable) products	Educational projects/ Information campaigns	Procurement directives	Integral planning
Contract management	Bonus scheme	Exemplary tender documents	Environmental follow-up-cost
Budgeting	System of duties	Calculation tools	Life Cycle Costing
Cost accounting	Bonus-Malus-System	Product databases	Contracting
Agreement on objectives	Certificate trading	Life Cycle Costing	Intracting
Auditing		Alliance of procurement	Conservation fond
Benchmarking		System of duties	Educational projects/ Information campaigns
Labelling/ Seal of quality			
Energy consumption controlling			
European energy award			
Eco-Audit (Eco Management and Audi Scheme)			
Municipal energy management			

CO_2-Management in companies is also part of the research project “Developing and testing of an integrated regional climate adaptation programme for the metropolitan area Dresden”[4] that have started in the mid of 2008. The main objective is the developing and testing of an integrated regional climate adaptation programme overall departments, sectors and levels for economy and society. Within this project we examine in addition to instruments for efficient energy management also questions concerning chances and risks of different branches with regard to climate change. Therefore we will develop economic scenarios on regional level and also for companies. A decision tool that contents a multiplicity of instruments and that is helpful for adapting to climate change will be one result of the research.

Berliner Energieagentur (2007): Beschaffung und Klimaschutz. Leitfaden zur Beschaffung von Geräten, Beleuchtung und Strom nach den Kriterien Energieeffizienz und Klimaschutz. Berlin, 2007 [Online: www.greenlabelspurchase.net/de-green-procurement-downloads.html]

Radgen, P. (1999): Die stillen Energieverbraucher, Karlsruhe, 1999 [Online: http://www.isi.fraunhofer.de/e/publikation]

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[1] Further information on the named initiatives can be found on their respective web presence http://www.klimabuendnis.org and http://www.c40cities.org

[2] German database for economics.

[3] Database of the German Federal Ministry of Environment.

[4] www.regklam.de

33.5 Climate Master Plan - Screening for flood prone areas in urban areas and the synergy and con-flicts in measures for climate change mitigation and adaptation

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It is important on an early stage to establish a Climate Master Plan based on overall screening of climate change consequences, possible measures for mitigation and adaptation and especially to identify conflicts and synergy in the use of measures. At a later stage the strategy in the master plan can be further detailed and specified for the most feasible solutions and measures seen as the best combination for mitigation and adaptation or very efficient for one of the purposes.

The Climate Master Plan including illustrations of the expected consequences as flood prone areas, storm surge and permanent flooded areas in the future, can improve the awareness of the climate change situation, independent of the climate change is caused by human activities, natural reasons or a combination.

The measures to be used for mitigation and adaptation can be in conflict or support both purposes in synergy. As an example the mitigation goes for very compact cities with high storage buildings and a minimum of transport while adaptation goes for open green cities with a lot of space to store or infiltrate storm water and to avoid heat-islands.

The presentation focus on methods and examples of screening of future flooding in urban areas and shows a catalogue for measures to adapt climate changes (rain, rising sea level, temperature, wind, sun etc.) including expected positive mitigation effects or conflicts. The Climate Master Plan, the climate change consequences in urban areas, adaptation measures catalogue and graphic presentation for improved awareness and decision tool will be illustrated by examples from Copenhagen Municipality and the huge infrastructure project Metro Cityringen in Copenhagen, including videos of the storm water flow in the streets, parks, railways etc. during heavy storms.

33.6 Energy City Frederikshavn - 100% Based on Renewable Energy in 2015.

Michael Kau, Frederikshavn Municipality, Denmark

Text Not Available.

43.1 Cheap and Beautiful: Explaining Energy Inefficiency within Construction

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Few would deny the importance of media in influencing our understanding of the challenges of climate change and in drawing attention to the ways in which climate change can be combated. This paper inquires into how the Danish media defines the difficulties in achieving energy efficiency in a sector of the economy that accounts for approximately one third of the EU's CO_2 emissions, the construction sector. Drawing on insights from science and technology studies as well as discourse analysis, the paper 1) identifies different types of arguments for why energy efficiency is not achieved, 2) problematizes the media's implicit understanding of decision-making processes within construction, and 3) questions what consequences this understanding of the construction process' character has for achieving energy efficiency.

The paper is based upon data retrieved from four daily newspapers[1] and six weekly or monthly professional magazines which represent the views of architects[2], building sector[3], engineers[4], municipalities[5], and business life in general[6] over a ten year time period, 1999-2008. This mix of newspapers and magazines covers not only the debate on energy related questions within the construction sector but also more broadly in society. These debates are seen as establishing and enacting particular distinctions of what energy efficiency entails (within the construction industry) and what means are considered relevant in terms of achieving or not achieving this goal. The media is not only a place in which the debates about climate mitigation take place, the media also brings and gives life to certain debates.

The paper shows that despite a seeming agreement on the necessity of enhancing energy efficiency in existing and new buildings, different media – and different professional groups – offer different explanations for energy inefficiency and suggest different means for achieving energy efficiency. Based on media content analysis of the media debates, we identify four different modes of argumentation for why energy efficiency is difficult to achieve. These are:

1) A lack of information, knowledge and know-how of different products and solutions
2) Negative incentives for energy efficient actions
3) Different modes of calculation and comparison that favour less energy efficient alternatives
4) Other priorities in conflict with energy efficiency

The first mode of argumentation builds on a deficit model, i.e. implicitly maintaining that if decision makers had more information regarding the technological possibilities for increasing energy efficiency, e.g. new window frames or forms of insulation, and on how these technologies are likely to affect other dimensions of the building, e.g. indoor air-quality, then they wouldbe more likely to choose energy efficient alternatives.

With regard to the negative incentives for energy efficient alternatives, several financing related issues are discussed, e.g. how property taxation and rental legislation are likely to make building owners and/or developers opt for less energy efficient alternatives.

The third set of arguments focuses on how choice is affected by different ways of calculating the economic costs of enhancing energy efficiency. Taking only the sales price of energy effective technologies or solutions into account is seen as hampering the adoption of energy efficient technologies, even though these are considered to be cheaper in the long run. In this case, inclusion of the long term costs of increased energy efficiency is seen as something that can lead to choosing more energy efficient technologies/products.

The fourth set of arguments is concerned with the conflicting priorities that crop up in construction processes. Much of this debate revolves around the building owners´ and architects´ aesthetic or quality related ambitions for a building as well as conflicting visions of what architectural work ought to include. For example, energy efficient elements such as solar panels are described as not fitting visually with building design, thus, implicating a conflict between the energy efficiency and architectural expression. Similarly building owners are criticized for giving the more visible aspects of renovation higher priority than energy efficiency; and in terms of architectural practice, energy efficiency concerns are seen as jeopardizing the creativity of the architectural processes.

Implicit in each of these four different modes of argumentation is an understanding of construction as rational decision-making process. Moreover, the decision-making processes are seen as focusing on three distinct priorities: 1) energy efficiency, 2) economic profitability, or 3) aesthetic and other quality concerns. In the media, these three different grounds for decision making are treated as separate, as if they could not exist in the same decision-making situation.

The paper discusses three questions related to these findings: First, much of the media debate is premised on the idea that things could be otherwise: information could change opinions, better incentives could change action and the parameters of calculations could favour the choice of other more energy efficient solutions. Yet, this does not happen. We discuss how the prevailing modes of knowing and becoming knowledgeable as well as choosing between alternatives are (re)produced and kept in place, and how these processes can be transformed. Second, we question the media's implicit separation of energy efficiency, aesthetics, and economic profitability. Instead we argue that in practice, decision-making is often influenced by a number of different concerns and ambitions that emerge over time. The third issue we address is the media's portrayal of construction as a rational decision making process. However, rather than continue is in this vein, we argue that it is necessary to attend to the emergent character of goals and opportunities. Portraying construction processes as choosing rationally between different alternatives, based on pre-existing priorities, will not help us understand the complexities of the 'greening of construction', nor will it help us to overcome the manifold and multifaceted barriers for enhancing energy efficiency.

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[1] Jyllands-Posten, Politiken, Berlinske Tidende and Børsen

[2] Arkitekten, Arktema

[3] Byggeriet
[4] Ingeniøren
[5] Nyhedsmagasinet Danske Kommune
[6] Ehrvervsbladet, Børsen

43.2 Delivering zero carbon housing in a free-market economy

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The United Kingdom has committed to a long-term target of reducing emissions of greenhouse gases by 80% by 2050, compared with the level in 1997. In December 2006, the Government introduced a target which specified all new build homes should be 'zero carbon' by 2016. This has generated a huge amount of debate within the house-building industry, amongst energy-service providers and policy-makers as to whether it is feasible in that time scale.

The policy is the first of its kind globally. It should help to reduce carbon-dioxide emissions and drive innovation within the house-building and energy industries, making developers and energy service companies more competitive in these evolving markets. Thus potentially it has a win-win outcome. However, the feasibility of delivering either is widely contested particularly without significant government intervention.

The United Kingdom can learn lessons from it's neighbours in Europe and some of the more progressive states in the USA in terms delivering energy efficient housing, energy-plus housing and decentralised renewable energy systems. However, the most successful examples tend to utilise both regulation and fiscal interventions. This does not sit well with the more laissez-faire, free-market approach of the United Kingdom which largely relys on innovation in the private sector driven by a non-existent market to deliver the revolution needed in the energy and housing industries.

The Zero Carbon Homes Project has sought to investigate the lessons that can be learnt from the European and American models and applied to the situation in the United Kingdom most effectively. This paper presents these findings.

43.3 Bridging the gap between economic and ecologic efficiency by individual energy consultancy

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Objectives:

The project of individual energy consultancy was designed to bridge the gap between climate protection and strengthening the regional economy.

The consultancy for private owners of flats and residential buildings was designed to increase the individual motivation of private households to invest in energetic modernization and to provide them with necessary technical information.

The measures recommended during a consultancy help to save energy on a long-term basis and improve the quality of buildings. The reduction of heating energy consumption and the improvement of thermal insulation contributes to decrease the private households´ share in the greenhouse effect. House owners employ local and regional craftsmen to carry out the energetic upgrading. For more comprehensive projects - such as carrying out combinations of several measures - the house owners also assign architects and planners. This shows that private modernization of buildings is a sustainable investment in climate protection and strengthening the regional economy.

Frame conditions

Verbraucherzentrale NRW has carried out this project of neutral energy consultancy in the "Ruhr-area", a region with about five million inhabitants which is characterised by a strong structural change and an unemployment rate higher than average. The project was funded by the Ministry of Economic Affairs and Energy of the State of North Rhine-Westphalia and the European Union structural funds.

Verbraucherzentrale NRW as a non governmental organisation advises, supports and protects consumers throughout the state in all consumer related topics. As with all other topics also its energy consultancy is neutral and independent of any economic interest. The organization advises individually and from a holistic perspective by suggesting economic and ecological balanced measures.

A high quality level is ensured by the fact that the energy consultants are well trained architects and engineers.

The public funding of the project is part of the regional development policy of the Ruhr-area related to the aim of energetic modernisation of its buildings. Many private buildings up to 8-12 accommodation units are in need of refurbishment and property owners face the problem of people leaving the region for good.

The energy-region North Rhine-Westphalia is trying to find a way from coal and other fossil fuels towards new and efficient energy technologies. The private consumers shall also be motivated to use efficient heating systems, improve thermal insulation, install renewable energies and to change their behaviour concerning heating and energy consumption.

Private households profit by reducing their energy costs, improving the quality of buildings and living comfort as well as climate protection measures, and a reduction in consuming fossil energy. The consultancy offer is designed to be an initial advise to help consumers create optimal plans for refurbishment measures. It opens doors for local craftsmen, architects and planners. The advise seeking consumers have been charged a small fee. and contribute in this way to finance the project.

Many private buildings are underdeveloped concerning the energetic and the constructional quality. So it was important to find the right moment and bring together individual plans of measures with an optimized energy saving concept. The results of consultation were motivated house owners - ready to start and knowing the right order of carrying out the appropriate measures.

More than three thousand households have been consulted in 3.5 years. The consultants visited the houses, so they had a real impression of the state of the art.

The result of evaluation by interviews of those consumers who had already been advised should give information about the needs of consumers and the success of the consultancies and the energetic modernization already carried out, induced or accompanied by the consultancies. Energetic and climatic values and the benefit to the regional regional economy by private investments should be determined.

Results

More than 50% percent of all advised house owners have energetically upgraded their homes according to the recommendations of the energy consultancy. For more than 30 percent of all upgrades the consultancy was the only or the predominant factor for the decision of the owners to refurbish their building. The estimated economic effects are 18 times the invested project costs.

70 percent changed their behaviour in using energy. Many realized an improvement in their problems with humidity and mould. The evaluation shows influences to a third party of the consulted households and a positive effect concerning the relation between proprietors and tenants.

An energy-saving of 75.000 MWh / year and a reduction 23,3 Kilotons of CO_2 / year have been realised.

The upgrading measures were mainly financed by the consumers own resources. Many of the investments were supporting the local and the regional skilled crafts and building materials suppliers and often architects and engineers were contacted. Therefore a neutral consultancy is able to support the skilled crafts and promotes employment.

Furthermore it could be shown that the consumers were highly satisfied with the quality of the neutral consultancy.

Therefore the regional offer to a neutral consultancy concerning energetic measures at private buildings is able to bridge the gap between economic and ecological efficiency and to contribute promoting local employment.

43.4 Architecture and Energy. Strategies for a Changing Climate

Michael Lauring[1] and Rob Marsh[2], (1)Dep. of Architecture & Design, Aalborg University, Risskov, Denmark; (2)Danish Building Research Institute, Aalborg University, Hørsholm, Denmark

Abstract: Architecture and Energy. Strategies for a Changing Climate.
By Michael Lauring and Rob Marsh

INTENT AND PURPOSE.
The paper aims to further integrated design of low energy buildings with high architectural quality.
A precondition for qualified integrated design is a holistic approach that on the technical side covers all sorts of energy used to construct, run and use modern buildings, and on the humane side includes functional, social and aesthetic aspects of modern living.
The paper shows how qualified integrated design up till now has not been achieved. It shows how a narrow focus on the solution of sub-problems may result in big problems elsewhere in the complex system of designing buildings. The paper concludes that future ambitious low energy building strategies cannot focus only on heat consumption but must include a stronger focus on the use of electricity for non-heating purposes and on the related architectural aspects: Building depths, spatial organization, daylight, natural ventilation and solar cells[1].
In order to get a truer, well-focused perception of how to design sustainable buildings, one needs to know basically what is more and what is less important among all the energy-related environmental issues. One of the main purposes of the paper is therefore to provide some sense of essentiality.
BACKGROUND.
The paper deals with Danish conditions which may differ from those of other countries when it comes to climate, natural resources, patterns of settlement, building traditions, education of builders, energy supplies and ways of living and working, just to mention some of the most important determinants. However, it can be assumed that many of these factors will be similar in countries in northern Europe with a maritime climate and an effective regulation of heat consumption in new buildings, and where the transition from an industrial to an information- or knowledge-based society is well-developed.
The last three decades of the 20th century show many conscientious – both governmental and architectural – Danish attempts at creating buildings with lower heat consumption. The lower U-values of the building envelope have had markedly good effects, but the regulation of window-area, sun and light has in general failed both regarding indoor climate and energy consumption. And the positive effects of big glass facades have been largely overrated[2].
In the Building Regulations of 2008, the rules concerning energy have been changed profoundly according to the EU-directive on the energy performance of buildings[3]. The rules take their starting point in two premises: To assess the whole and the primary energy consumption. Included is the needed energy for heating, cooling, hot water, lighting (not in dwellings), building services (like pumps and ventilation) and the system losses (heat loss from internal plant, pipe work etc). On the other hand building integrated energy production from solar heat and solar cells is included in the assessment. For calculated overheating going over 26 degrees, the electricity for running a standard cooling system to eliminate the overheating must be included in the assessment.
FUTURE STRATEGIES
As the above shows, much attention has to be paid to non-heating purposes. The question is whether the focus is now broad enough? Another question is what will happen in the light (and heat) of global climate changes: In what way will they change the focus and the needed strategies?
If we take a look at the current primary energy consumption in typical new terraced houses, heating stands for 23% while hot water is 12%, cooling 11%, building services 8%, lighting 7% and appliances are 39%. All in all heat purposes are 35% while electricity covers 65%[4]. Out of the consumptions the

current Building Regulations cover 54%, but not the last 46% (lighting and appliances). These tendencies are more radical when it comes to offices. The figures for typical new offices are that heating stands for 16%, hot water is 5%, cooling is 10%, building services are 6%, lighting is 9% and appliances are 53%. All in all heat purposes are 21%, while electricity covers 79%. Out of the consumptions the Building Regulations cover 47%, but not the last 53% (appliances). All together this calls for a much broader focus with stronger emphasis on electricity.
A recent publication[5] combines the above mentioned current consumptions with future climate changes. In the calculations the temperatures are set to rise (compared to 2010) with 0,5 degrees in 2020, 1,4 in 2050 and 2,7 degrees in 2085, which is in the lower end of IPCC's estimation of average global temperatures expected to rise between 1 and 6 degrees in the 21st century[6]. The calculations show that the primary energy for cooling may rise approximately 40%, while heating may drop 30%. Inside the next 25 years consumption related to cooling may exceed consumption related to heating in dwellings built according the current regulations. In a typical new office cooling may rise 40% while heating may drop 15%. All ready now, the cooling consumption is often bigger than the heat consumption.
These calculations indicate that climate scenarios should be integrated as part of the regulative and designing process to quantify the effect of cooling-reducing strategies. They also indicates that passive design strategies should be combined with active strategies to control overheating, strategies such as daylight regulation, sun shielding, controlled natural ventilation and thermal mass.
The figures strengthen the viewpoint that light buildings are preferable to deep and darker buildings both from an architectural and a low energy perspective, an viewpoint that is further substantiated in the paper.

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43.5 The shaping of new sustainable housing concepts in Denmark

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A number of so-called sustainable housing projects have been or are planned these years in Denmark. Some projects have also been constructed and are in use. The aspects of sustainability which are in focus vary, but energy consumption in the house during use and resource consumption and environmental impacts related to construction materials during manufacturing, construction and/or use are often in focus.

A research project focusing on the experiences from such recent Danish projects is conducted by Department of Management Engineering at Technical University of Denmark and the National Building Research Institute at Aalborg University 2007-2009. Six sustainable housing projects are analyzed in order to develop an understanding of the mechanisms in planning and use of such housing projects and develop proposals for future research, innovation, and diffusion within the field. The project addresses the following topics in the analyses of the case studies:

· What type of actors are initiating this kind of housing projects and why?

· What type of actors and entities are involved in the planning of the houses and which interactions takes place between the different types of actors and entities and between different types of competencies? How much are these relations building on existing business relations and how much are the relations set up for the specific planning processes?

· What role has standards played in the planning of the houses?

· What issues in relation to resource consumption and environmental impact have been addressed? What strategies were developed for these issues?

The case studies of housing projects represent a variety in relation to a) the present stage (planning, construction, use) and b) different ways of organizing the planning process, especially with respect to the role of municipalities, future occupants and environmental intermediaries. All analyzed projects are based on one-family houses or semi-detached houses.

Each case study comprises of interviews with some of the involved actors and collection and analyses of different types of written materials. The project includes furthermore an analysis across the different cases and development of proposals for future research, innovation, diffusion within the field.

The research project is based on theories within the approach of social shaping of technology (SST), which implies that each sustainable housing project is seen as part of an ongoing interaction between environmental discourses and environmental strategies, the dynamics of the construction sector, the dynamics of municipalities and the dynamics of living conditions. Within the SST-approach an actor-network approach is applied with focus on the development of scripts for a housing project, including the role of boundary objects and brokers, and product chains. The project has identified a number of different initiators to new sustainable housing projects:

- municipal administrative staff in order to influence future construction of houses in the local area
- local green intermediary in order to make sustainable houses which may attract ordinary citizens
- building component company in order to initiate development of new building concepts

- co-operative housing association to support development of more sustainable housing concepts

The different initiators have tried to enroll other stakeholders in their initiatives and establish housing projects. The municipal administrative staff and the local green intermediary were able to enroll the city councils and also enroll construction companies, which wanted to construct house and citizens who wanted to buy houses. However, some projects have also experienced lack of enrollment of important stakeholders. Problems engaging either construction companies or citizens to some projects show the role of demand and supply within the housing area. Some projects have had problems finding citizens who were willing to buy a house in an area allocated for sustainable housing when the housing market suddenly had a surplus of houses for sale and in one project no construction companies were willing to accept the guidelines for a housing project, when a piece of land was put for sale with demands for the companies, which wanted to build on the land.

Different types of standards have influenced the shaping of the projects. The new Danish construction guidelines for new houses with stronger demands for the energy consumption and efficiency have influenced some projects. The new Nordic eco-labeling guidelines for family houses has been developed and tested as part of one of these case studies. Other types of standards that have played a role are local guidelines for housing projects and internal company standards for houses, which imply that a construction company prefers to convince existing suppliers to change their products than to include new suppliers in their supply chain. A concept that has influenced two of the projects is the so-called passive house concept, where houses are supposed to have rather low energy consumption. The strongest focus among sustainability aspects has been on energy consumption. Some cases have also focus on reduction of environmental risk from construction materials.

The projects represent different levels of innovation with respect to building technology. One company based on standardized houses wanted as little innovation as possible in order not to have to change suppliers and change their production equipment. One project involved foreign designers because they found Danish designers too traditional. These findings show the need for studies of the diffusion of sustainable housing technologies: whether and by which mechanisms such diffusion takes place.

The project findings show the need for detailed studies of the citizens' actual domestication of new sustainable houses, so-called design-in-use or description of the developed script for a housing project, in order to understand those processes by which technologies are made to work (or not work) and are given meaning by households through acquisition, placement, interpretation and integration. Achieving the predicted low energy consumption was difficult in a project where the houses had been in use for a period. Another project showed the attempts from the construction company to ensure the predicted low energy consumption by providing the instructions for use and maintenance, which are demanded as part of the Nordic eco-labeling criteria for one-family houses.

44.1 Renewables - important challenges for transmissions system operators

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Promotion of renewables in electricity production introduces new challenges to the sector. Procurement, installing and connection to the existing grid of thousands of MW (12000 MW) in a short period of time represent a real challenge to the Romanian electricity system (17000 MW). Not only new high voltage lines (400 kV) and substations are needed, but also new regulation regarding to the definition of necessary system reserves and their level.

This new challenge makes more actual the question if the electricity only market forces could normally lead the system to a medium term security/adequacy. There are concerns that in real life the electricity only market cannot assure the adequate capacity at all moments. The signal given by a high electricity price could have diferrent roots as a lack of producing capacity, energy resources or congestion. A more dedicated signal, led by market forces, should be developed on different types of medium term requested capacities.

The Romanian Energy Regulatory Authority developed in July 2007 a regulatory framework for a capacity mechanism as a first step in order to ensure a more specific signal, to ensure on medium term the adequacy of the system and reward all generators which contribute to effective competition or to system reliability.

A mechanism to *ensure today enough proper capacity for medium term (about 4 years)* and to put on market basis this managing activity of the surplus capacity could be appropriate, together with redesign of the actual European technical procedures to determine the necessary system reserves.

It is sustainable for the society to ensure a market mechanism, which provides the financial resources for units offering proper medium term adequacy of the electricity system in order to let the in-efficient units which can provide adequacy, not to operate.

A *medium term* capacity market could give the correct signal for new efficient units in order to assure the medium term adequacy of the system and also it could give the surety on an adequacy of the system from capacity point of view. It recognizes in time the potential capacity shortfalls (or surpluses) before they actually occur, thereby facilitating the capacity investments that would avoid the price volatility that results when electricity supply becomes limited.

TSO should determine the necessary capacity (including the type) for each year of the near future period of time based on the estimated demand received from suppliers and long term system and generation planning studies. This period of time should be about 4 years in order to allow the building of new capacity. A longer period would bring the estimation errors and stranded cost in unneeded capacity. TSO could awards certificates for each capacity available in the target year according to the net available long term/peak capacity, differentiated by various categories of reserves/plants, in order to be used on the market by each production company.

The market mechanism should require to each supplier to medium term secure or contract for sufficient proper reserve capacity to match his customer profile according to the system operator specification, bilaterally/ offers to the capacity market operator/ via auction. Those consumers who need higher power reserve should buy more reserves. The money would be paid in the year in which capacity is appointed. A penalty system has to be considered for both demand side and supply side of capacity.

In the other hand, taking into account the huge present possibility, from the technical point of view, to efficiently use the renewables potential, especially wind, to produce electricity, the redesign of the necessary system reserves has to make a step further than the biggest installed unit and the variation over prognoses of the load.

The dimension of the installable wind power has to be determined based on the installed and new coming capacity qualified for ancillary services in the electricity system, the instantaneous, in all steady states, not average, available ancillary services, the characteristics of the existing and new coming wind farms (installed power, simultaneous power, wind potential and its characteristics), network congestion etc.

The paper will contain a short description of the present situation of the Romanian electricity system, the actual regulatory framework focused on capacity mechanism (obstacles and results) and possible new developments of the regulatory framework regarding to the definition of necessary reserves, their level and the economical impact on the electricity system from the perspective of the wind energy.

44.2 Renewable Energy and Regionalisation

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The renewable energy production and use has been growing in the European Union. However, there are large differences between the EU Member countries in terms of the fossil fuel use and in the renewable energy use and growth. Moreover, there are large regional differences in the renewable energy use between the Member countries and within a Member country. The national and regional differences cannot be explained by the differences in the economic structures of the countries and regions. The renewable energy production and use is related to socio-political aims. Several regions aim at regional renewable energy development. Alongside with the renewable energy growth that is envisaged for the European Union as a whole, one can expect emergence of the regional renewable energy centres in the next decade. The business and environmental opportunities due to the policy aiming at the regional renewable energy centres are shown on the basis of a programme in the Frisian region. The study into this programme shows that the effective policy instruments are not technology grants for the investments but reduction of the investments' risks in the renewable energy and regional policy instruments in addition to the national policies such as feed-in tariffs can be found. However, the choice of policy instrument depends on the political considerations that must also take into account other priorities such as job creation in the short-term which can lead to other priorities for implementation than the risk reduction for the renewable energy investments. The paper advocates inter-regional co-operation in the area of renewable energy, which can foster policy instrumentation.

44.3 Local energy planning in cooperation

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It is well known that energy supply and use leads to environmental impact and the local level has often been highlighted as important when it comes to the transition to a sustainable energy system. In Sweden there is a legal requirement for local authorities to produce a municipal energy plan for managing energy systems at the municipal level. How such planning shall be performed to be effective has however been subject for debate. This paper describes a cooperation project in a Swedish region where eight local authorities are producing their energy plans in a joint procedure. Throughout the process the local authorities will receive support from for the regional development council in cooperation with other regional actors such as the county administrative board and the university. The local authorities will for example be offered professional training and process support, but also, and perhaps most importantly, they will be offered an arena for discussion and networking.

The design of the process is based on the experiences from earlier initiatives for supporting strategic energy work at the local level, as well as research on energy planning and how it can be performed to be effective. The experiences from this project can serve as valuable input to practice for managing energy systems at the local level.

44.4 Towards carbon-neutral heat supply: Heat Atlases as a planning tool for climate conscious cities

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Introduction

Heat supply in cities comprises a significant contribution to climate change. Heat supply to buildings requires low temperature heat, which most efficiently can be produced with heat pumps, geothermal heat or the cogeneration of heat and power, and through urban district heating networks. District heating is an established technology, which covers roughly 50% of the Danish heat supply to the built environment. Future district heating systems will have to face several challenges: heat sources need to be less carbon intensive, which can be achieved using renewable energy or waste heat sources. As these sources generally are limited and characterised by higher costs, investments in these sources may need to happen alongside investments in energy savings in the built environment. Finally, heat distribution may be subject to efficiency measures. What is common to all these factors is that they depend on the geography of urban areas and regions. An analysis of the potentials, costs and policy requirements must therefore be based on a highly detailed, large scale model of urban heat demand and supply. This paper presents the design and the use of an urban Heat Atlas for Denmark, which is composed of publicly available data on the built environment and urban heat supply. Three cases are presented, which 1) describe the conversion of predominantly oil boilers and 2) of individual natural gas heating to collective heat supply in climate conscious cities, as well as are used for 3) designing carbon-neutral heat supply infrastructures. The results of applying Heat Atlases deliver important quantitative data and information for urban decision making processes. Not only are the potentials of converting to district heating mapped and available as numerical data, but also the investment costs associated to the establishment or the expansion of district heating networks are calculated. Potentials and costs are then composed to continuous cost-supply curves, which facilitate the political process of converting urban energy systems. In addition, the Heat Atlas methodology delivers data for the required investments in additional heat supply capacities; and returns maps of CO_2-emissions caused by several forms of individual and collective heat supply. In addition to the applications sketched in the present paper, further use of the methods described here are within urban carbon accounting, the reconstruction of urban areas in environmentally benign manner, as well as integrative studies of urban climate change mitigation. The Heat Atlas hence comprises a practical tool for renewed urban heat supply planning, which in the present form is applicable for all Danish towns, cities and regions.

Heat Atlas design

The heat atlas presented here quantifies and locates the heat demand in the built environment. It specifies the heat installations of buildings (boilers, district heating, heat pumps etc.), the fuels used in individual heating (natural gas, oil, biomass etc.) and the existing collective heat supply technologies found in an area (district heating, natural gas or none). For each building, the net heat demand for room heating and hot water is calculated using registered building data, complemented with empirical building and user data. Also, the potential for heat savings by insulating existing buildings is assessed based on these data. The costs of connecting buildings to new or existing district heat systems can be calculated using data on heat demand density and distance to existing infrastructures, combined with empirical data from actual installation works. Together with information on the energy plants used to produce district heating, a heat atlas may cover the entire process chain from end-use heat demand to useful, or secondary, heat and to primary energy or fuels. As all these parameters are specified by geography, the heat atlas is designed as a geographical database using geographical information systems (GIS). The completed heat atlas comprises a geographical database of heat demand and supply, which can be used for spatially explicit analyses of changes to the geography of heat supply. For every new setup of supply, as specified in the next chapter, the heat atlas will yield data on the potentially connectable buildings and their heat demand, the affiliated costs, and the additional heat to be produced by the existing district heating plants.

Spatial analysis of urban heat supply

A geographical or spatial model of the urban heat supply, demand and future supply options forms the basis for spatially explicit analyses of potentials for carbon free heat supply and its associated costs. For cost-supply analysis of the conversion of individual natural gas to district heating, the potential for district heating and estimated investment costs were included in a spatially explicit economic model with the single building as the smallest entity. A potential for district heat exists for all buildings, which are not currently connected to district heat and which are located within areas of sufficient heat demand density and within reach of existing infrastructure. The costs are consequently calculated for each building not currently connected and located in a neighbourhood without district heat distribution network. The neighbourhood is specified as a 1 hectare standard square cell of the Danish Square Grid. If there is at least one building in one of these cells, a district heating network must exist nearby, and costs of local distribution networks and transmission radials are avoided. The reason to have this rule is that district heating areas in the heat plan typically exceed the extent of actual installations. Also, municipalities have used different ways to delineate these district heating areas, which therefore are unfit for being used here.

44.5 Carbon Emission Reduction in Shanghai: Responding to Climate Change Mitigation

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In this paper, energy consumption characteristics and energy intensity in Shanghai were analyzed. Status of carbon source and carbon sink in Shanghai were estimated using the existing known methods. Result shows that the total carbon emission varies significantly depending on the share of renewable energy in energy mix. The carbon emission in Shanghai increased but carbon emission per unit GDP in Shanghai dropped, a result of energy efficiency improvement. Further reduction of carbon emission per unit GDP is dependent on policy innovation, new technology breakthrough or transformation of social economic pattern.The carbon sink in Shanghai is expected to maintain at the current level or achieve some increase in the future, depending on the implementation efforts of policies and technology innovation. The current policies related with carbon emission reduction were summaried. Some suggestions on related policy were proposed.

44.6 Developing a Model of the Irish Energy System

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The transition from a fossil-fuel to a renewable energy system is a modern and complicated challenge for numerous countries. However, as Ireland is an island that is poorly interconnected to other energy systems, this challenge becomes even more complicated. Identifying how to make this transition is a vital step due to the scale of the change required for large-scale renewable penetrations. In this paper, a model of the Irish energy system is created to identify how Ireland can transform from a fossil-fuel to a renewable energy system. The energy-systems-analysis model, EnergyPLAN, was chosen to create the model as it accounts for all sectors that need to be considered for integrating large penetrations of renewable energy: the electricity, heat and transport sectors. Before various alternative energy-systems could be investigated for Ireland, a reference model of the existing structure needed to be created. This paper focuses on the construction of this reference model, in terms of the data gathered, the assumptions made and the accuracy achieved. In future work, this model will be used to investigate alternative energy-systems for Ireland, with the aim to determine the most effective energy system for integrating significant quantities of renewable energy.

45.1 Sustainable Urban Infrastructure.

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Text Not Available.

45.2 Climate Solution

Thy & Mors; H.P. Korsgaard and B. Bolt-Jørgesen, Klimaløsninger Thy & Mors

Text Not Available.

45.3 C2C – Sustainable Islands

A. de Vries, Provincie Friesland, the Netherlands

Text Not Available.

45.4 A Sustainable Sønderborg: Partnership for achieving significant CO_2 –emission reductions in 'no time'

M. Vestergaard, Sønderborg Municipality, Denmark

Text Not Available.

55.1 Refurbishment or Replacement of Buildings – What is Best for the Climate?

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Introduction

In 2008, the Norwegian Bank "SpareBank 1 SMN" decided to reestablish their headquarters in Trondheim, Norway. The old facilities were considered to be increasingly inadequate, not very functional or usable with respect to changes in the performance of bank services today and in the future. The existing headquarter building was from the early 70s.

The challenge was to decide whether they should rehabilitate the existing building or demolish it and construct a new building. The project presented in the paper addresses this issue. The paper shows the usefulness of life cycle models as input to a decision making process in a feasibility phase of the project.

Methodology

Several studies have used life cycle assessments to measure the impacts of energy consumption in different building stocks in a quantitative way (UNEP, 2007). But as an input to decision making for building owners or contractors evaluations of environmental performance of buildings, these studies have often been less helpful, as they to a great extent have been limited to the environmental impacts associated with the manufacture of building materials. The experience of both producers and contracting authorities has been that decisions are taken on the basis of insufficient information with regard to environment and economics in a life cycle perspective.

The methodology used is a merge of the Life Cycle Costing methodology - LCC and Life Cycle Assessment – LCA (Rønning et al., 2007). Calculation of the environmental profile for the whole building was based upon data from databases, NAMEA statistics, general LCA software and the Norwegian LCC-standard.

The comparison is based on calculation of greenhouse gases related to the phases *Building construction (cradle to gate for building materials and components), Operation, Maintenance and Development* during the life span of 60 years of the two alternatives. Demolition - or *End of Life* – was not included in the comparison, but is included in the general model.

The total energy demand for the existing building is relatively high, 524 kWh/m^2. The goal for the new or refurbished construction was a net energy demand on 85 kWh/m^2. The existing construction is considered to have low adaptability and area effectiveness. Thus, the comparison must take into consideration a relatively extensive refurbishment including upgrading of the existing building.

While the new construction's condition with respect to operation, maintenance and development was assumed to be "well adaptable", the refurbished construction's state was defined as "medium adaptable". Due to the low adaptability for the refurbished construction the energy consumption after refurbishment would probably be reduced to 300 kWh/m^2. Those assumptions influenced the results significantly.

Results

From a climate point of view the most favourable strategy is to replace the existing construction and build a new construction. The results are illustrated in Figure 1.

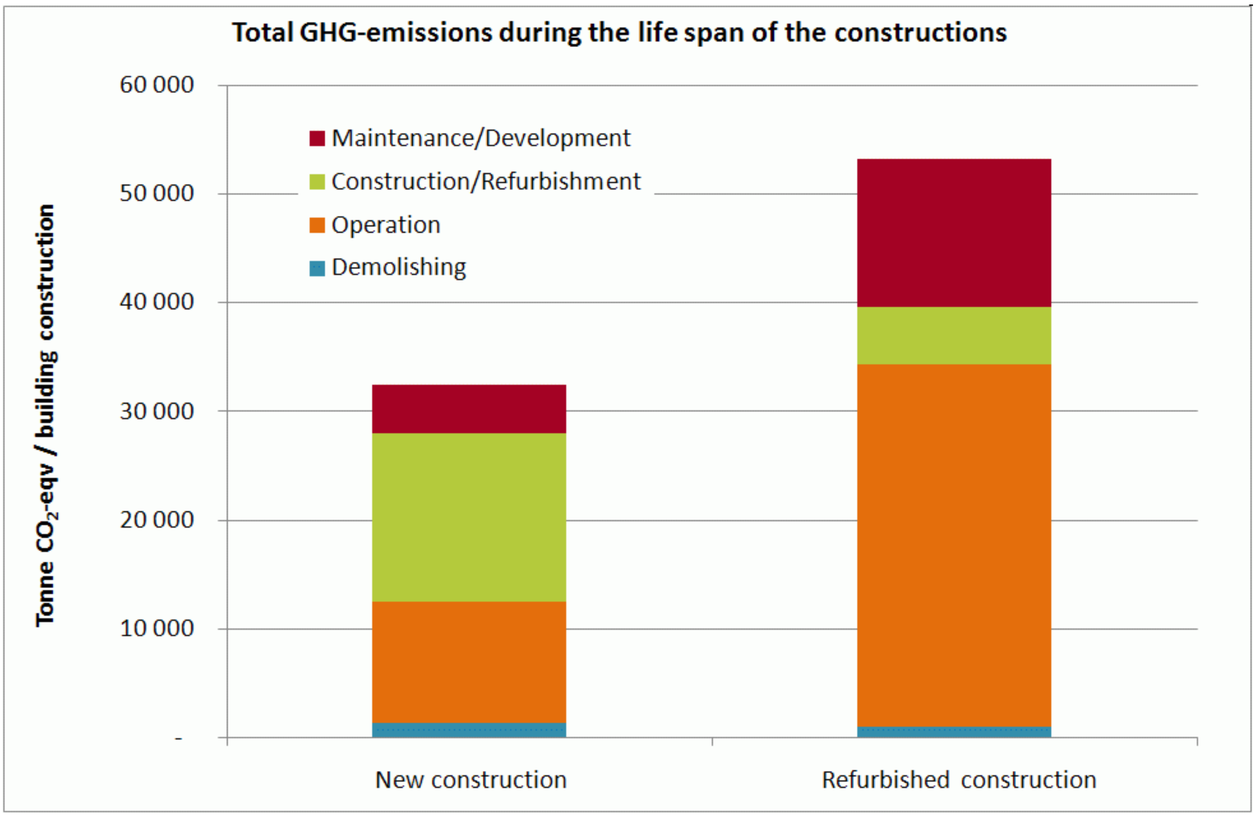

Figure 1 Total emission of greenhouse gases given in CO_2-eqv. *for* new and refurbished constructions during 60 years.

Figure 1 shows the emissions related to producing and constructing the new building are more than twice the size of the refurbished construction. On the other hand the emissions related to operation, maintenance and development of the refurbished construction are three times the size of emissions related to the new construction. This is mainly explained by the low adaptability and flexibility of the refurbished construction.

This conclusion is further strengthened when comparing emissions per employee since the new construction is more area effective and makes it possible to increase the number of work places from 500 to 600. This gives a total emission per employee of app 100 vs. 50 tonne CO2 equivalents.

The demolishing pay pack time is approximately 14 years as given in figure 2.

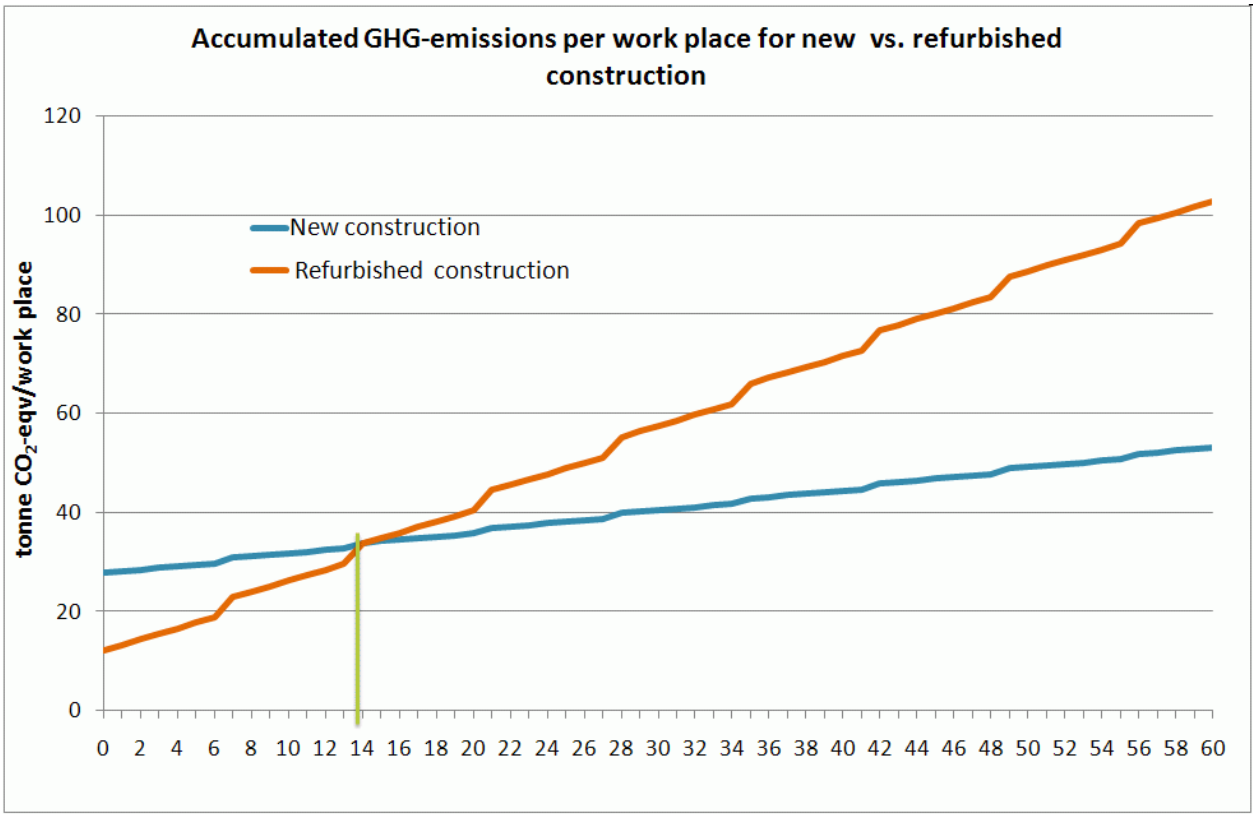

Figure 2 Accumulated emissions of greenhouse gases during 60 years given in CO_2-ekv. *for* the new and the refurbished constructions.

The results are sensitive to the estimates done, especially the merge of data for investment planning and material flow data. On the other hand the estimates are in the same order of magnitude and direction for the two different cases.

The results from this study were one of the main inputs to the decision process in the pre-construction phase. SpareBank 1 SMN concluded to replace the existing building. It is already demolished and the construction of the new building has started.

SpareBank 1 SMN has documented as much as 99% of the demolished materials including furniture and fixtures have been delivered to reuse or recycling.

The results from the case study show the usefulness of life cycle models as input to a decision making process in a pre-construction project.

Further work

The methodology in this study has been used to evaluate the environmental consequences of the decisions made in a feasibility phase of the project. In that respect the data used – a sort of hybrid LCA combined with the scenario strategies in LCC methodology – were suitable to distinguish between the two alternatives. The results from the simulation of the two alternatives were considered to be suitable to advice the decision made by SpareBank 1 SMN. In addition, the results confirm the findings in previous studies that one can accept higher environmental load in the construction phase if the way the combination of building materials and solutions are affecting each other increase the adaptability of the construction and therefore reduce the emissions during the life time of the building.

To make the model adaptable for choosing materials and solutions in the construction phase, the input data has to be product or producer specific. In addition a critical part is the definition of the scenarios representing the life cycle planning of the construction as given in figure 3.

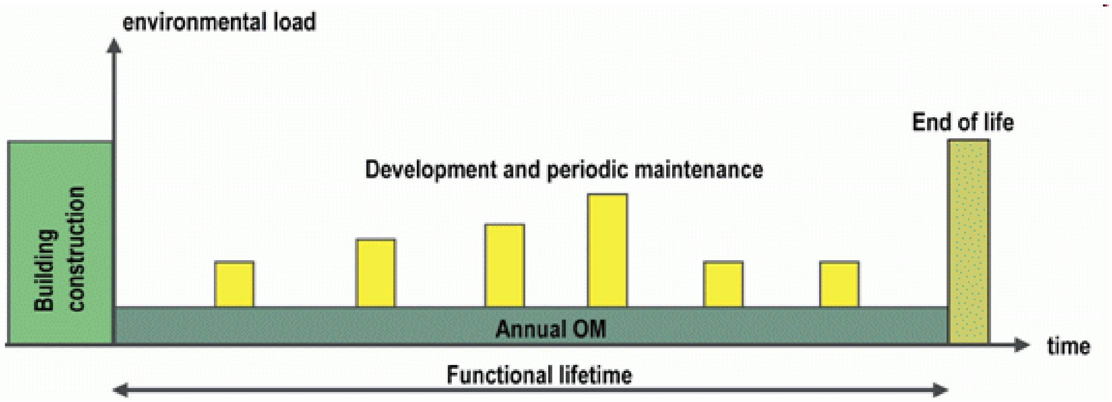

Figure 3 Life cycle phases of a building (Rønning et al., 2007).

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55.2 The first "Comfort Houses" in Denmark - Experiences of different design processes.

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Text Not Available.

56.1 Emerging Governance Systems for Renewable Energy – The Case of Danish Municipalities

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The establishment of sustainable ways of living is probably the most complex challenge that societies nowadays face. Not only can the term 'sustainability' only be abstractly defined, but simultaneously are the issues that need to be dealt with in a sustainable way characterised in manners that have been described as wicked, unstructured or persistent. The main difficulties for such problems of 'unsustainability' to be tackled are the dynamics in which they occur and/or are perceived both on different societal levels and time scales. This means that the nature of those problems is both highly uncertain and that appropriate solutions are not given a priori. This leads to a continuous flux between an abstract end point called sustainability and the various pathways developed over time and geared towards such an end point. Since no one can know for certain the best way to achieve sustainability, it could be argued that reaching consensus concerning sustainable solutions most obviously should be approached by a cooperation of a range of actors, including governments, industry, citizens, knowledge institutions, NGOs etc..

Renewable Energy Systems

With regard to energy systems one pathway towards sustainability could be termed the development of renewable energy systems (RES). Although this seems to be a more tangible term it still is debatable and depending on contextual factors what RES actually will entail. It can therefore be expected that a number of RES will emerge, each having different 'degrees of sustainability'. In such a context of uncertainty and complexity it is necessary to support certain concrete solutions, while at the same time remaining flexible to new and potentially better solutions in order to prevent lock-in situations. Here the involvement of a number of (local) actors seems to be crucial for several reasons, for instance: i) new (technological) solutions require societal acceptance in order to be (economically) feasible; ii) behavioural changes and investments on the demand side (e.g. energy efficiency and savings) depend on the willingness of citizens; iii) the current small-scale character of a number of renewable energy technologies allows for potentially diverse, distributed system configurations and therefore requires local planning. From an energy political point of view the initiatives and engagement of local actors would therefore be welcome and should be supported in a flexible way.

The Case of Denmark

In the particular case of Denmark distributed energy systems have had a comparably long history, and during the last 30 years experiences with especially locally produced combined heat and power (CHP), wind power and biogas have been gained. Furthered by national policy the bottom-up initiatives of farmers and cooperatives became feasible and popular. As certain technologies, especially wind power became more visible, conflicts of interest called for a better planning of (renewable) energy. Municipalities have in this regard traditionally played a more passive role of the approving authority. More recently, however, a number of municipalities are becoming more active and have developed rather ambitious future energy strategies that go beyond national targets for renewable energy, energy savings or reduction of CO_2. In this regard Danish the role of municipalities is two-fold: i) all municipalities have to follow the national framework for energy (e.g. wind power planning, development of municipal heat plans) and ii) some municipalities are beginning to work in fields traditionally not part of their tasks (e.g. transport, energy savings).

Aim of the Paper

It is therefore interesting to investigate how new energy planning initiatives in the municipalities are supported by the national level. In this paper we examine the possibilities for municipalities to do energy planning in new fields (e.g. energy savings and transport), for which they seemingly lack institutional support. We pay particular attention to processes of co-evolution and communication between the national and local level in negotiating this support. The existing legal background for municipalities, recent cases of cooperation between the national and the local level, as well as case studies in a number of frontrunner municipalities form the empirical basis for this study. The paper concludes by discussing the possibilities of municipalities to support the emergence of renewable energy systems under the current framework.

56.2 Comparative Study of the Potential of Renewable Energy Sources and Solutions in Denmark and China

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Comparative Study of the Potential of Renewable Energy Sources and Solutions in Denmark and China

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Abstract
This paper compares the potential of renewable energy sources and solutions in Denmark and China. Denmark is one of the leaders in renewable energy sector and represents a remarkable transformation. Even through lacking almost entirely in hydroelectric resources the government has build up one of the biggest renewable energy sectors in the world. Nowadays, excess 20% of the electricity demand in Denmark is supplied from wind powe and renewable energy accounted for approximately 27% of total gross electricity production in 2007. Meanwhile China is the biggest developing country in the world and endowed with abundant renewable energy sources. Along with the high-speed economic development and increasing energy consumption, the Chinese Government faces a growing pressure for maintaining the balance between energy supply and demand as well as reducing environmental pollution. To ensure energy security and mitigate climate changes, the inappropriate energy consumption structure should be changed. As an alternative, a suitable infrastructure for the implementation of renewable energy may serve as a long-term sustainable possibility. In the past few years more attention has been paid to the development of renewable energy, and laws, policies and planning initiatives have been implemented to support the development of renewable energy in China. Based on the comparative analysis of renewable energy sources and solutions between two countries, this paper presents a foundation and experiences for developing renewable energy systems in China.

Key words: comparative analysis, renewable energy, Denmark, China

56.3 Mechanism to Promote QUALITY of Transmission Service

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The aim of a price control regulation is to protect consumers paying correct prices, while ensuring the company remains viable and having an incentive to operate efficiently. The price control signifies a constraint on the overall level of the company revenue and corresponding prices.

The Romanian Energy Regulatory Authority (ANRE) has selected and implemented in the year 2004 the revenue cap regulation.

The transmission system operator (TSO) has an exclusive monopoly over the provision of transmission services granted by the Romanian Law. The price control applied by the Romanian regulator for the first time in 2005, has a major scope to protect consumer interests by a fair allocation of the gains resulted from the increase of efficiency over the targets set by regulator, between TSO and customers. Transmission tariffs are based on justified cost. Their stability is realized by the smoothing mechanism over the regulatory period. In order to close the balance sheet of the company from prognoses/estimation to achieved values, annual and at the end of the regulatory period corrections are performed.

The schemes applied to controllable operating a maintenance cost and, from the second regulatory period, losses gave to TSO the incentives to increase the efficiency of its activity in order to increase their profits on short term. These schemes also gave to TSO the base in establishment of new efficient investments. More, using a rate of return applied to the average assets base registered in each year of the regulatory period versus a cost plus methodology, gives the incentive to TSO to invest. Only the efficient investments in the transmission network are considered by the regulator.

Penalties are applied by the mechanism if, it doesn't receive the proper attention from the TSO.

In order to ensure the quality of the transmission service, according to the special provision of the Electricity Law no. 13/2007 (no. 318/2003), quality standards are in force for supplying, distribution, transmission and system service beginning with the year 2008.

The performance publication represents the basis in promoting the quality. The quality standards with overall and customer guaranteed standards make sure that no uneconomic degradation of quality occurs. Overall guaranteed standards are levels of performance set by the regulator and companies must use their best endeavours to comply with them, or penalties are applied. Customer guaranteed standards are levels of performance which must be achieved in each individual delivery of a specified service. Customers who fail to receive the required level of service under a guaranteed standard may be entitled to receive a penalty payment.

The incentive schemes represent an even more powerful instrument to promote the improving of quality, in the establishment of investments. Price and quality are closely related: each quality is associated with a price adjustment.

The company's performance is compared to some quality target; deviations result in either a penalty or a reward. There are many variations of quality incentive schemes. Price and quality can be mapped continuously, in a discrete fashion, or a combination of these, the level of the penalty or reward can be capped, dead bands may be applied etc..

The idea for this capping is to reduce the financial risks at the company and customers. The dead band is introduced in order to avoid, on short term, the stochastic element which can lead to significant quality fluctuations and as result, unintended penalty and reward fluctuations. Asymmetries between penalty and reward are possible.

At present, ANRE intends to impose an incentive scheme for quality of transmission service related to the continuity aspect. It monitors the Energy Not Served – ENS and Average Interruption Time – AIT for transmission service and balancing energy requested due to the network congestion and their annual costs for system service. For technical and commercial aspects, guaranteed standards are in place. In order to promote the stability of the tariffs, the correction's cap of the associated revenue is calculated based on the smoothed revenue to be covered by tariff.

The evolution of the ENS (unplanned interruptions caused by TSO), except force majeure, varies between 80 and 387 MWh for period 2004 – 2008. The investment program, configuration and the low loading level of the network allowed the TSO a good efficiency in this field.

A sensitivity analyses will be performed on the target of the incentive scheme, considering a dead band of ±20% and an inflexion band of ±40%.

The paper will present, for a discount rate of 10%, the variation of the consumers gain and ENS price over the study period 2004 – 2008 with target considered for the incentive scheme.

In order to reduce the financial risk and the stochastic variation, the scheme continuous with cap and dead band is considered as appropriated. The proposed target of the scheme is 120 MWh of energy not served (unplanned interruptions caused by TSO) with a dead band of ±20% and an inflexion band of ±40%.

More, for calibration, two options are considered as transitory application of the scheme: with a correction cap of ± 2.5% of associated yearly revenue without correction of the next tariff period revenue or with a correction cap of ± 1.0% of associated yearly revenue with correction of the next tariff period revenue. After the transitory period, the level of the correction cap established by the Romanian regulator will not be over ± 2.5% of associated yearly revenue, according to the tariff methodology in force. Accordingly, the correction cap associated to the year 2008 is 2.66 mil Euro for the cap of ± 1.0% and 6.64 mil Euro for the cap of ± 2.5%.

New developments are considered regarding to the undelivered energy from generators and, for the quality of the system service, to the congestion, as soon as more historical data will be available.

56.4 Biodiesel, a Carbon Neutral Alternative fuel to Petroleum Diesel

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Biodiesel is an alternative petroleum diesel fuel made from renewable resources such as recycled cooking oils, vegetable oils or animal fats rather than petroleum. Biodiesel is produced by the transesterification of a vegetable oil or animal fat with an alcohol (methanol or ethanol) in the presence of a catalyst (sodium or potassium hydroxide). Starting material may include: used cooking oil, soybean, corn and canola. Converting biomass feedstock to biodiesel and the use of biodiesel in transportation to replace petroleum diesel supports climate change by reducing the atmospheric CO_2 in several ways. Diesel associated emissions are avoided, the CO_2 content of diesel remain in storage; and by harvesting new biomass for fuels we provide a mechanism for CO_2 absorption by photosynthesis.

Soybean, Canola, and other oil-producing plants tend to be limited to around 100 gallons of Biodiesel per acre of Land. They also require good quality land, thus competing with food crops. Microalgae have a potential to produce 5,000 to 10,000 gallons of Biodiesel per acre of Land. Therefore the UNH Biodiesel Group is investigating microalgae as a potential valuable source of biodiesel feedstock oil. The energy and labor inputs required for growing algae can be substantially less than those for land crops. Microalgae require light, nutrients, and carbon dioxide, and have the ability to grow fast in regular, brackish and salt water. While being grown in a photo-bioreactor, they convert light and produce much more oil per unit area of land compared to vegetable plants. Claims are that some microalgae store over 50% of dry mass of their energy reserves in oil droplets

The UNH Biodiesel group has been studying the growth lipid-rich algae. In addition to nutrients algae require a carbon source. The carbon source can be CO_2-rich flue gas from combustion or aerobic digestion of waste products. The grown lipid-rich algae could then be harvested and used to produce biodiesel. This paper will discuss the UNH Biodiesel Group experience.

57.1 Regional socio-political factors influencing deployment of emerging energy technologies for climate change mitigation in the United States: Comparative study of three states

Tarla Rai Peterson[1], Jennie C. Stephens[2] and Elizabeth J. Wilson[3], (1)Wildlife and Fisheries Sciences, Texas A&M University, College Station, TX; (2)International Development, Community, and Environment, Clark University, Worcester, MA; (3)Humphrey Institute of Public Affairs, University of Minnesota, Minneapolis, MN

We explore socio-political influences on deployment patterns of two emerging, low-carbon, climate-mitigating energy technologies in the United States (US). We use media presentations and personal interviews with key energy policy actors in Massachusetts, Texas and Minnesota, U.S, to identify important patterns in state-level socio-political norms and structures related to wind power and carbon capture and storage (CCS) technology. Through comparative content and frame analysis of newspaper coverage and through interviews with critical energy technology actors in these states, we clarify variation in the salience of wind and CCS technology, and compare public framing of the technology's risks and benefits.

57.2 Strategies towards a 100% renewable energy system for Denmark in the Future Climate Project.

Brian V. Mathiesen, Aalborg University, Denmark

Text Not Available.

66.1 Energy Management – a Standard for Handling Energy & Climate Activities.

Kim Christiansen, Dansk Standard

Text Not Available.

9.1 Promoting Transitions to a Low Carbon Economy: Anticipating the Sticking Points

Andy Gouldson, Sustainability Research Institute, University of Leeds, Leeds, United Kingdom

With appropriate policies and supportive markets, many would hope for a smooth transition to a low carbon economy. Indeed, in some quarters, there has been a considerable degree of optimism that such transitions are technologically and economically viable and that – with the introduction of appropriate policies and the removal of non-market barriers – they can happen relatively easily. However, it seems more likely that there will be a phased evolution towards a low carbon economy, with a number of 'sticking points' being encountered along the way. This paper will argue that in the first phase of transition, which roughly coincides with the 20-30% emissions reductions targets set by actors such as the EU for 2020, low carbon options are available that can be politically, socially, economically and technologically viable. However, it will also argue that as these options are exploited, greater challenges are likely to be encountered. Will social learning take place in the first phase of transition that allows these greater challenges to be met in the second phase? Or will the viability of future options diminish as the costs escalate? Two recent examples from the broader environmental policy sphere – one macro and one micro - will be used to illustrate what can happen at this critical juncture, and lessons will be drawn for contemporary debates on policies for a low carbon economy.

9.2 Environmental Sustainability in the Russian Federation: Assessing the Potential for new forms of 'societal governance'?

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Environmental Sustainability in the Russian Federation: assessing the potential for new forms of 'societal governance'?

This paper examines the inter-relationships between the Russian state, private firms and Russian environmental NGOs in an effort to determine to what extent new forms of 'societal governance' are developing in Russia in the area of sustainable development. This paper outlines the results of empirical research undertaken in a Russian region during 2008, which involved interviews undertaken with a variety of actors including state officials, environmental regulators, company directors, company environmental experts and Russian environmental activists.

In 2000, *Goskomekologiya* – Russia's State Ministry for Environmental protection, a key stakeholder on pollution control in Russian firms was abolished. Such an example of a retreating state in Russia vis-à-vis environmental protection has occurred with Russia increasingly being governed by a system of blended elites or 'state corporatism'. In order to consider the consequences of the corporation supplanting or substituting for the state, Matten & Crane's model of corporate citizenship is used as a theoretical framework (Matten & Crane: 2005). They argue that where firms take on such a role or where ruling and business elites are blended, that the firm becomes a *purveyor* of citizenship rights onto its constituents or stakeholders. This stands in contrast to the more traditional corporate social responsibility view that sees the firm as a citizen with attendant responsibilities, including environmental protection This article purports placing Matten and Crane's treatise within the broader political philosophical framework of Habermas which seeks to examine how changes brought about by globalising processes are intrinsically impacting on forms of global governance, state-societal relations and in particular the ability of governments to regulate economic activity. Habermas argues that with the emergence of globalisation, economic activities have increasingly crossed the previously territory-bound validity of state regulation and thus undermined the sovereignty of nation-states, namely the state's ability to independently set rules regarding private economic activities within its territory of control (Habermas 2001). As Habermas states, there is a need to move towards new understandings of societal governance, arguing that the legitimacy of 'state-like' actions of private corporations ultimately depends on the political embeddedness of the corporation and its actions. In particular, focus is given to the role of self-regulation of the corporation itself, and to what extent such processes take place in collaboration with civil society actors such as NGOs and citizens themselves. In such a fashion, the researcher can address the issue of legitimacy, relating to how, when and if the 'state-like' corporation can be controlled and regulated in a democratic fashion and thus legitimate itself as a political actor and in a more general sense, one can determine to what extent new forms of 'societal governance' are emerging in Russia in the field of environmental sustainability. As such, this paper examines to what extent in Russia strategic partnerships between corporations, civil society and government structures are creating 'boundary-spanning' dialogue, helping to resolve challenges of sustainable development (Eweje 2007)

In this paper we raise a number of questions with regards the impact of state corporatism on environmental sustainability in Russia. Do Russian firms – despite their ability to influence government policy and decision making – view themselves as corporate citizens, with a responsibility to protect the environment; or do they now see themselves as purveyors of citizenship, and thus upholders of an individual's right to a clean environment? Alternatively, Russian firms may see themselves as neither citizen, nor purveyor of citizenship – an outcome of state-corporatism unacknowledged by Matten and Crane – and simply use their position to sidestep the need to undertake any pollution control activity. Finally, we seek to assess the response of the Russian environmental movement vis-à-vis the emergence of state-corporatism and the retreating Russian state by assessing to what extent Russian environmental NGOs see themselves as citizens? To what extent can Russian environmental NGOs influence firm behaviour vis-à-vis the environment? To what extent can Russian environmental NGOs influence government policy making in the sphere of environmental protection?

Keywords: governance, environment, sustainability, Russia, state, business, civil society

9.3 *Green Networks: 15 Years of Danish Experience*

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Collaboration in networks is increasingly being used in order to address the formation and development of problem solving, knowledge building and learning in and between organisations and individuals.

Networks are more flexible forms of organisation and are seemingly more appropriate when handling complex problems and activities that are difficult to define and which must include a broad set of stakeholders.

Not surprisingly, at the 2002 Earth Summit (WSSD) in Johannesburg, it was concluded that public-private partnerships should be one of the pivotal mechanisms of greening. This underlined the shift in regulatory regimes that had been going on for more than a decade. Moving from largely command and control measures and media-shifting in the 1970s and 1980s, through cleaner production initiatives and self-regulatory initiatives in the 1990s, the emphasis is increasingly on using networks and partnerships as levers for promoting a greening of industry.

Kirschten (2005) refers to for example Innovation Networks, Sustainable Networks, Social Networks, Ecologically oriented Networks, and Sustainable Innovation Networks and discusses their aims and partners. Bäcstrand (2006) use the term multi-stakeholder partnerships when discussing the more than 300 public-private partnerships that have become one of the results of the WSSD in Johannesburg in 2002. Lehmann (2008) develops the notion of public-private-academic partnerships and proposes special roles for universities in relation to sustainable development. All do they suggest that despite differences in names and focus, these networks may perhaps best be discussed from an outset in governance.

In this paper, we reflect on the 15 years of Danish experiences with network forms of public-private partnerships, discuss their roles in relation to environmental governance, and their potentials for dealing with issues of climate change.

Setting the Scene

During the 1990s, the role envisaged for industry in the ecological transformation of society changed considerably. Ecological modernisation was the term used to describe the emergence of a new societal paradigm, which inherently involved a shift from reactive and passive attitudes in industry. The insistence that pollution prevention is costly and thus minimizes profits, is replaced by a new era where win-win solutions that create profits for greener companies are emphasized. Out of this discussion on self-regulation and pro-activeness, the idea of public-private partnerships grew.

In their most general form, networks consist of a number of relations (technical, social, institutional), connected by way of nodes. These nodes may have different characteristics but will often consist of different types of social actors (individuals, organisations, groups), material and immaterial artefacts and resources (e.g. techniques, buildings, materials), and activities (such as meetings, decision-making, learning).

During the early part of the nineties, a number of Danish municipalities and counties developed mutually committing partnerships with the private sector. The partnerships often had an environmental focus and were established on the premise that environmental protection and private sector development could in fact walk hand-in-hand.

At the same time and aided by these partnerships, the regulatory centre of attention was gradually changing both in form and in focus. From an arms-length and command & control approach to regulation (government) to an inclusive, self-regulatory approach (governance); and from problem-solving, media-shifting (dilution, end-of-pipe, etc.) and production-oriented to problem-mitigating and product-oriented.

The resulting networked governance provided space for strategic dialogue between and within the participating organisations, i.e. both public and private, resulting in early implementation of strategic environmental management.

Results

The first network that were initiated with this focus was the Green Network in the then County of Vejle (today located in the regions of Southern and Central Denmark).

Starting out in 1992 with five municipalities, the county and about 50 local companies, the network is a story of an away-defeat and home-win. The formal establishment of the network took place in June 1994, where the six public authorities and 29 companies committed themselves to work progressively with environmental protection and business development. Primarily, the focus was on continual improvements in lieu of traditional environmental management with a coupling to occupational health & safety.

Today, the network has grown to a total of almost 300 members and the work is diversified and in addition to environmental management also specifically entails occupational health & safety and social responsibility.

Besides the developments in focus, activities and outreach, the Green Network has been role-model for additional networks in Denmark and helped establish their umbrella organization, Key2Green (originally Environmental Forum Denmark). The original manual for Environmental Management has been revised and through Key2Green available to the networks' members (about 800-1000 organisations).

The activities in Green Network and its 'sisters' have created results on several fronts. First of all, more and more organisations have started working pro-actively and on a continual and strategic basis with environmental improvements (through integration of an environmental management system). Second, this work has often been used as a stepping stone to enlarge and institutionalise (by the development of new manuals explicitly aimed at these aspects) strategic efforts encompassing OHS and other activities pertaining to the social responsibility of companies.

The resulting palette of manuals aimed directly at facilitating easier uptake of these concepts in small and medium-sized enterprises and not just in larger corporations (something that other established approaches, e.g. ISO14001, AA1000, etc., have often been criticised for not being able to), has resulted in an uptake that is earlier and larger than what can be statistically expected (Formann et al., 2004). This is indicaties that the work done in the network, the resources committed and the activities carried out push in the right direction.

The way ahead

The question now is, can the networks be used as vehicles to also engage stakeholders in a committed, systematic and continual drive to combat climate change? Building on previous successes, can the networks develop concepts and manuals that are appropriate for also smaller companies and businesses to provide for joint, local action on Climate Change? And, with the diversity of their membership, what are the perspectives for the networks to provide for a (regional) Green New Deal to tackle a triple crunch of credit, oil price and climate crises?

9.4 Networks for Sustainable Business Development

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Text not available

10.1 *How to Achieve 80% reduction of computers' climate impact*

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The TCO-label has included energy saving criteria for displays since 1992. In EuP reports, it is clear that PCs that are operating in "on" mode when they not in use directly leads to an unnecessary climate impact. Therefore TCO Development started cooperation with the house of culture in Stockholm to address this problem. The solution is "Green IT organization, certified", a new labeling system which is currently being developed and tested together with the house of culture, a part of Stockholm municipality. Based on EuP studies, TCO Development has calculated that an optimum use can reduce the climate impact of PC operation by 60-70 %.
To achieve stabilization at approximately 2 degrees warming, IPCC estimate that during the present century, it is necessary to decrease emissions to levels of approximately 50 to 85 percent of today's levels. The way to reach this is a combination of green progressive procurement and environmentally friendly usage.
A combination of today's commercially available products combined with a change in user habits lead to a concrete saving capacities amounting to about 80 or 90 percent, which is in line with IPCC figures. When purchasing a new computer, there is a differential factor of 10 from the best to the worse from a climate perspective.
When it comes to usage, each computer monitor or notebook that is unnecessarily switched on is in itself not a problem. However, when we consider that worldwide computer sales in 2007 totaled 268 million units, it becomes clear that the difference between optimal operation of an energy efficient product and sub-optimal operation of an eco-deficient product design can create vast differences in carbon dioxide emissions. Every hour of unnecessary usage of these 268 million PCs amounts to 340 million kWh of energy consumption, and 17,000 tons of CO_2[1]. 80 % reduction of climate impact from computers
In EuP studies, it is calculated that approximately 70 percent of the climate impact comes from the use phase. This means that green procurement in itself does not solve the problem alone. The combination of activities in both procurement and user habits at work can therefore be powerful.
In Sweden there are two interesting examples that, when combined, can make a significant difference when it comes to climate impact. One is the case of the TCO label (see above), the other a case of Green procurement with huge impact.
Verva, the Swedish Administrative Development Agency, coordinates the procurement of framework contracts for products and services in the fields of information and communications for the entire public sector. The last procurement for PCs was worth over 6 million EURO purchased over a period of 2 years. The "green" aspect of the procurement process was probably one of the toughest in the world. The two most interesting requirements were, firstly, the demand for a 20 percent lower energy consumption compared with Energy Star and, secondly, a special section for green PCs with stringent environmental specifications that had a greater weighting in importance than price. This type of procurement requirement has the potential for making a significant contribution to climate impact from PCs in Sweden. Figures will be calculated during beginning 2009.

10.2 Carbon footprint labeling – how to have high data quality and to maximize utilization

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Introduction

The issue of carbon footprint and product labeling is hot on the environmental agenda. The pros and cons are vast. The pros are obvious; it includes a broad variety of opportunities for actions and intensives which by use of better information hopefully will lead to better decisions for the climate. The cons include statements such as it is overwhelming resource demand in terms of costs and time, and that it can be questioned if it is possible to make meaningful carbon footprint labels.

In this presentation, firstly we will demonstrate that GHG emissions for carbon footprint labels can easily be calculated using a hybrid approach for life cycles assessment (LCA) implying a relatively low degree of uncertainty. Secondly, we will present some of the potential future uses of carbon footprint.

Hybrid LCA and calculation of GHG emissions

The traditional approach for calculating GHG emissions related to products and services is the so-called process-based LCA, where a number of processes are identified and included as part of the product system. The processes are normally linked via physical flows (based on engineering knowledge). A major problem of this approach is that a broad variety of inputs are usually excluded from the product system, e.g. business travelling, marketing, consultancy, accounting, legal assistance, education, buildings, machinery etc. This is acknowledged in the ISO 14044 and 14044 as well as in the PAS2050, but neither of them provides a solution to the problem.

To overcome the problems of cut-off rules, input-output-LCA (IO-LCA) can be used. IO-LCA is based on a nation's total economic transactions combined with total emissions accounts (NAMEAs). Therefore, such data do by definition include all above mentioned inputs which are typically excluded from the calculation of GHG emissions. It is not unusual that GHG results obtained from IO-LCA is 50-150% higher than those of process-LCAs. This is due to the difference in completeness in data. The main problem of IO-LCA is that it typically does not include more than 100-500 product categories, and that many products belong to inhomogeneous product categories in the IO-table. Also the reference flow in IO-LCA is typically in monetary units which may make the interpretation difficult. However, some IO-tables exist in hybrid units (e.g. physical products are measured in mass unit, energy is measured in energy unit, and service products are measured in monetary unit).

If the starting point of the calculation of GHG emissions is IO-data, the most important inputs, such as energy and feedstocks can be replaced by process-based LCA data. This approach is referred to as hybrid LCA and it benefits of the completeness in data from the IO-LCA and the detailed modeling in process-LCA. An iterative approach can be applied where the importance of inputs are evaluated, and where the most important inputs, for which more precise data are available, are replaced. By doing so, for each iteration the LCA will be associated with less uncertainty and it will be more resource demanding (costs and time). Thus it is possible to define an acceptable/optimal level of uncertainty depending on the benefits from the use of the carbon footprint label.

Uses of carbon footprint labels

Carbon footprints have many potential applications. The most important uses are listed below:

Product information to the users

Carbon footprint labels on substitutable/competing products can lead to more climate friendly choices

If only some of the substitutable/competing products have a label, the remaining products can be labeled with a residual label (residual = all products minus products having a label). This would create an incentive for non-labeled suppliers to label their products and to reduce GHG emissions. Then the process become self-perpetuating

The most widely used LCA software is SimaPro (www.pre.nl) which comes with the World's most comprehensive and well-documented LCA-database; ecoinvent (www.ecoinvent.ch). Having a carbon footprint label, this can be included with brand and company name in the ecoinvent database. This may further strengthen the above mentioned self-perpetuating effect because the residual may become worse for those who are not providing their own data

Carbon footprint labels can be included in the bar code of a product which can serve several purposes for the individual customer, e.g. having a total footprint for all purchases, comparing this to alternatives or to other similar customers, setting and monitoring personal targets, all of which may be supported by web-based tools.

It can be concluded that the obstacles on carbon footprint has been overcome; the calculation of GHG emissions from products can be done with relatively little resource input (costs and time), and with high completeness in data and with relatively low level of uncertainty. By labeling products we will have much better information on the relationship between our actions and our impact on the climate. Such information can by used for better climate solutions by politicians, NGOs, scientists, and actors within production, trade, and consumption.

10.3 Carbon Footprint and Labelling of Dairy Products -Possibilities and difficulties

Anna Flysjö[1], Christel Cederberg[2] and Jan Dalsgaard Johannesen[1], (1)Arla Foods, Viby, Denmark; (2)SIK - the Swedish Institute for Food and Biotechnology, Gothenburg, Sweden

During the last couple of years there has been a large focus on food and its contribution to global warming. Food production is one of the major contributors of green house gas (GHG) emissions. Especially the livestock sector is dominating the GHG emissions, as it stands for approximately eighteen percent of the anthropogenic global warming (Steinfeld *et al* 2006). The rising concern about humans' contribution to global warming has put a pressure on industry, politicians and other stakeholders to act. As one reaction, carbon labelling has come up as one attempt to reduce the emissions of greenhouse gases from products, by helping consumers to choose products that give rise to less GHG emissions.   Lifecycle assessment (LCA) has since beginning of the nineties been used to calculate the environmental impact (where contribution to global warming is one impact category) from products, using a lifecycle perspective. The large focus on carbon labelling has started a development of standards and guidelines, specifically designed for calculating the "carbon footprint" of products. One of the most discussed is PAS 2050 (2008), prepared by British Standard Institute (BSI). The PAS 2050 is to large extend based on the ISO 14040 (ISO 2006a) and ISO 14044 (ISO 2006b), but is in some areas more specific on how to calculate the carbon footprint. However, there are still room for interpretations, as well as in the ISO standard, and it is therefore important to discuss what various assumptions might result in. Analysing the contribution to global warming from food products might be even more difficult than for the other sectors (eg electricity, energy, transport) dominating the emissions of GHG, since agricultural systems consists of biological process, which are complex processes and calculations/estimates include large uncertainties.   ***Possibilities*** At the dairy company Arla Foods, the energy use and its related GHG emissions has been reported for more than ten years. For 2005 and onwards the total GHG emissions have been calculated (i.e. total carbon footprint), from "cradle to gate" (including milk production, all inputs to the dairy, transports and delivery to store and also waste management at consumer). This is a first step in the company's goal to reduce their GHG emissions by 25% by 2020 (compared to 2005 year's level). The reduction goal includes all activities at the dairy site, all packaging material and all transports. However, the production of the milk is not included. The method on how Arla Foods works with and reports their GHG emissions is presented here. Also the total carbon footprint from the company is presented together with a discussion on possible ways to continue from here. The largest GHG emissions, however, occur at the primary production, and the paper also put emphasis on understanding the activities before the dairy, i.e. the milk production.   ***Difficulties*** Milk and dairy products are here also used as example to show the difficulties with carbon footprint; 1) methodological aspects on how the calculations are performed, 2) the uncertainties with biological systems. Milk is one of the more frequent food items investigated using LCA and here previous studies are used to illustrate what the results are, based on various assumptions.   Analysing different methodological aspects on how to perform carbon footprint on milk shows there are some critical aspects to consider. One of the choices, which might give largest variation to the results, is how to handle by-products. The cow does not only produce milk, but also meat and calves, which is used for meat production, and it is therefore necessary to distribute the environmental burden (i.e. GHG emissions) between milk and meat. Various ways exists how to do this, and here a comparison is made between system expansion, physical-causality allocation and economic allocation (Cederberg and Stadig, 2003). Also, different farms produce milk in different ways (i.e. uses different feeds and other inputs), which gives that milk from different farms give rise to different amount of GHG emissions (Cederberg *et al* 2007, Cederberg and Flysjö 2004). So comparing the carbon footprint (at least for milk) from different studies can be very difficult.   Except the methodological issues, there are also uncertainties in the calculation of for example methane and nitrous oxide, due to the complexity in the systems and difficulties to measure. Methane is responsible for around 45-65% and nitrous oxide for around 20-35% of the total GHG emissions for milk (ex farm gate). Here a simple sensitivity analysis is made on the emission factors used for calculating methane and nitrous oxide, to show the uncertainty and importance of these emissions.   However, even though there are different possibilities to calculate and many uncertainties, it is still important to assess how large the contribution to global warming is from various products. Hence, it is important to know what different choices and assumptions might have for effect on the final results. It is also important for stakeholders to get an understanding of the complexity of the systems and not to stress decisions or take decisions on wrong information/bases.   ***References***

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22.1 A New Deal in the governance of climate change

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A New Deal in the governance of climate change

In spite of wide-spread consensus on anthropogenic climate change, confirmed by high profile publications such as Stern's *Economics of Climate Change* (2006) and the Intergovernmental Panel on Climate Change *Fourth Assessment Report* (2007), some contend that such publications have stoked the fire of controversy as opposed to encouraging consensus[1]. These contenders suggest that the summarised information provided to decision makers seemingly presents a consensual view, masking uncertainties and nuances expressed qualitatively that exist amongst the 'experts' that feed into this body of evidence.

This is driven by the need for evidence based policy, for which there is an apparent preference for pure scientific evidence. This is typically focussed on a means-end outcome given the, hitherto, neoliberal emphasis in the governance of developed countries. However there is a growing concern that pure scientific evidence isn't sufficient in itself to provide solid foundations, given the varied and unpredictable nature of many environmental issues[2]. Furthermore, the current economic crisis raises questions about short termist approaches to governance. Thus policy consensus should go beyond scientific consensus[3]; taking into account wider considerations before legitimate decisions can be formulated – in particular if striving for a paradigm shift or a 'new green deal'. Therefore, a new approach is required that will forge communication across key stakeholders in the attempt to build consensus.

The Delphi technique is one vehicle by which this capturing of views and deliberation can take place[4]. This is a novel application of the technique; originally developed specifically to reduce the impact of powerful personalities on other participants in bringing disparate and remote experts to a consensual position. There has been much debate about the consensus generated by Delphi studies, in that it can appear to be forced or artificial, glossing over the finer nuances represented to create a one-size-fits-all consensus. Increasingly, literature surrounding Delphi has begun to recognise that it has value in providing a true reflection of the diversity in participant views.

This has also been recognised in the burgeoning Deliberative Democracy literature, suggesting that a veritable democracy should reflect deliberation and communication between actors[5]. Whether this could suggest a role for Delphi in the advancement of opportunities in the governance of climate change was thus explored by interviewing a sample of experts who have had previously participated in a Delphi study, conducted by the researcher in 2007. Combined with this experience, and gaps identified in an in depth literature review; the research objective sought to understand participant reflections on the role and importance of consensus versus a plurality of views in the governance of climate change and whether the Delphi technique could thus be a contributory tool.

The empirical findings emanate from five in-depth semi structured telephone interviews with former Delphi panel members. 17 people who had previously agreed to participate in follow-up research were invited to participate, with the five people that agreed yielding a 29.4% response rate. Grounded theory (GT) was the adopted strategy for data collection and analysis[6].

This research demonstrated that consensus was not deemed necessary for the successful governance of climate change, although its uses are acknowledged in simplifying a message for a particular audience. Rather, the findings suggest that a legitimate outcome should not be stifled by forcing or aggregating views into a seemingly consensual position, but to draw on the diversity of views and opinions, actively engaging with participants so that the iterative rounds can focus the attention on agreed key areas. Thus, the research reinforced emerging literature that the Delphi technique is a useful tool in gathering a disparate range of views[7], refuting its original purpose of arriving at a consensus[8]. However, its advantage of removing the impacts of powerful personalities remains key; thus Delphi may be more successful than other face-to-face alternatives. In order to maximise the utility of the outcomes from a Delphi approach, there are issues associated with demonstrating legitimacy that may impair its outcomes if left unaddressed, though process transparency could help overcome these hurdles.

In moving forward on climate change governance, it is essential that there are a number of tools adopted so that a true reflection of society can be created and incorporated into robust policies. The Delphi in itself is not, and will never be, a panacea to the threats of climate change. The results go someway in suggesting that it is one tool that can help reflect the wider picture for decision makers in gathering views and communicating with stakeholders, as opposed to solely relying on narrow means-end evidence, hitherto provided by natural scientists in a neoliberal framework of governance. In doing so systematically, and transparently; the legitimacy of any decisions taken will be bolstered, justifying a course of action which could otherwise come up against fierce resistance in the attempt to realise ambitious mitigation targets. This is particularly true in the governance of climate change, where to stimulate sufficient mitigation drastic changes in current engrained societal behaviours is likely. This ultimately may help in increasing trust in and knowledge of the reality of the pressing issues, and may result in a more successful approach in encouraging more pro-environmental behaviour across the board. The current economic crisis, whilst used by many to delay mitigation action, provides a clear opportunity for a departure from a 'business as usual' scenario to achieve a 'new green deal'.

The limitations acknowledge the constraints of time, and that the research represents insights which are in no way generalisable. However, the implications of the research have relevance for policy and other decision makers who are charged with advancing climate change mitigation.

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[1] Oppenheimer et al. 2007; Yohe et al. 2007

[2] Wallington and Moore 2005 [3] Wilenius and Tirkkonen 1997 [4] Wilenius and Tirkkonen 1997, Benn et al. 2008 [5] Benn et al. 2008; Dryzek 2002; Heysse 2006; Kerkhof 2006; Pellizzoni 2001

[6] Glaser and Strauss 1998, and Charmaz 2000 [7] Rowe et al. 2005 [8] Helmer 1968

22.2 The importance of interpersonal relations in green networks – experiences from Denmark

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The importance of interpersonal relations in green networks

– **experiences** from Denmark.

Four green networks are established in the southern part of Jutland in order to initiate activities that facilitate an extended collaboration between local and regional authorities and companies.

This abstract presents some of the preliminary results of a project initiated to analyse how interpersonal relations influence the collaboration between authorities and companies.

Dialogue-based networking is the main means of facilitating collaboration between authorities and companies. This type of networking goes beyond public regulation to self regulation facilitated through strategic dialogue. This calls for new roles. The environmental authorities must combine enforcement and facilitation at the strategic as well as at the operational level.

At the theoretical level, an analytical framework is developed to address the interpersonal factors influencing the dialogue. This theoretical framework draws on social psychology and communication theory and highlights:

1) The importance of personal attitudes, competences, proximity and the sense of familiarity.

2) The institutions which are carried into the dialogue through roles and scripts which are confirmed or negotiated in the dialogue and through power relations

3) The communicative practise carried out in the interpersonal relation through codes, media, rhetoric and means of establishing and maintaining the dialogue.

In this paper, we will address the importance of personal attitudes, proximity and the sense of familiarity, by drawing on empirical data from qualitative interviews with environmental inspectors as well as environmental employees from companies. To analyse the factors built into the analytical framework, both the inspectors and the companies filled out a questionnaire assessing the importance of a series of variables. The variables are, together with the results, presented in Figure 1. Figure 1 is based on 17 interviews.

As the figure shows, attitudes and the sense of familiarity and proximity matter in the strategic dialogue. However, proximity seems to have its limits, as it is considered to be a barrier to the strategic dialogue if the involved actors know each other in private. However, several variables addressed in the analytical framework are assessed by the partners as being of considerable importance to the outcome of the dialogue.

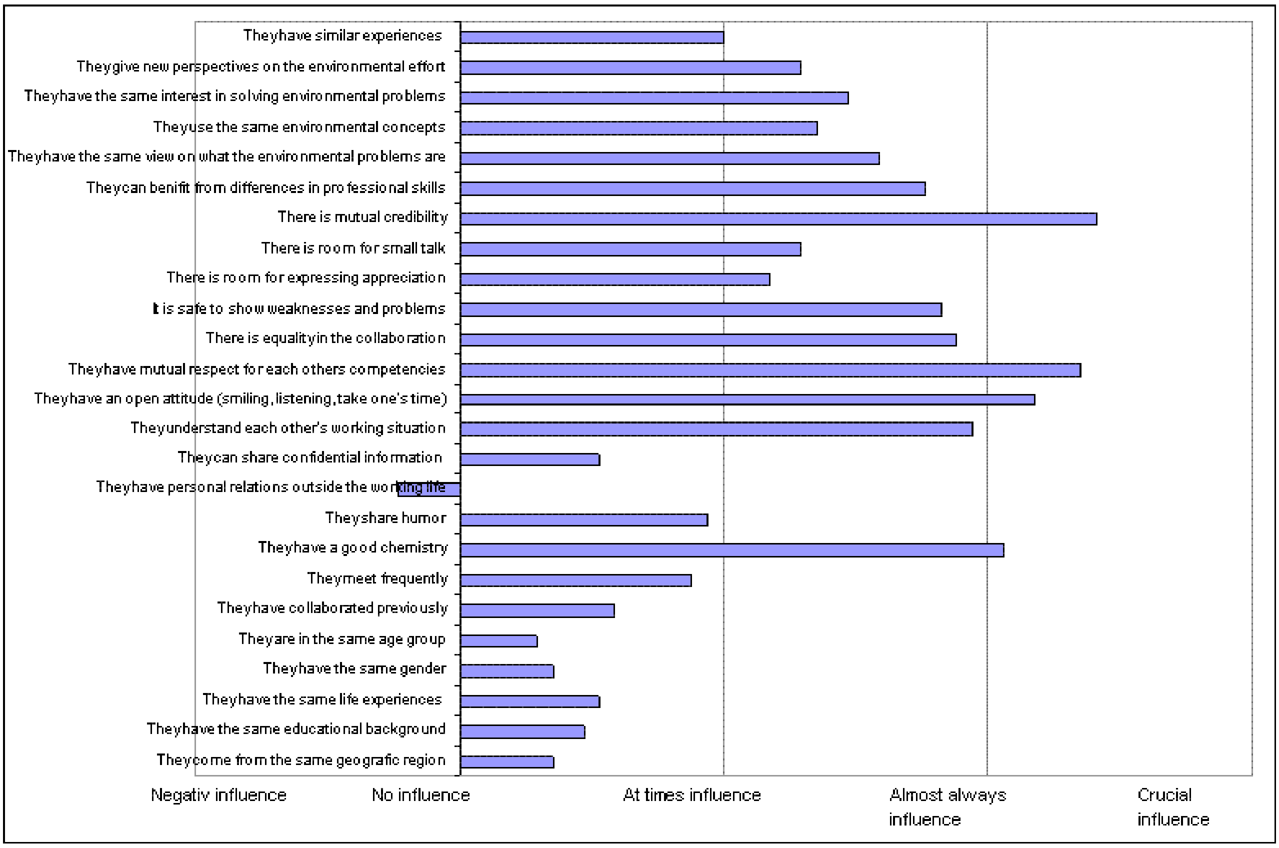

Figure 1: Illustration of the average score for a number of factors influencing the collaboration between the company and the public environmental inspector.

The results of both the questionnaire and the interviews show that especially trust, equality, mutual credibility and respect for each other's competencies influence the collaboration. The roles that facilitate the establishment of these factors are very dependent on the individual perception of the tasks, but most of all, dependent on the possibility of creating a dialogue-based collaboration. In this collaboration, the environmental inspector demonstrates his willingness to move beyond the regulator role; not telling the companies how to comply with regulation, but informing them about the aims of environmental performances. In this case, it is up to the companies to design the solutions.

Furthermore, the analyses show that not only do the dialogue-based environmental inspections lead to a more positive perception of the inspectors; the companies also become more positive towards environmental improvements. Those companies that decide to join the green networks improve their environmental effort beyond the requirements of environmental legislation. For some companies, this includes the implementation of renewable energy and the reduction of energy consumption.

The strategic dialogue serves to negotiate the traditional role systems and power relations, and this leaves room for synergy. Furthermore, the green network and the meetings within the network play an important role in terms of setting the scene for the strategic dialogue. However, nor the practise of the strategic dialogue or the maintenance of the green network will guarantee a successful dialogue and environmental momentum. Interpersonal relations matter. They might not be able to change role systems, but this paper shows a need for paying more attention to proximity, familiarity and the match of personal attitudes in network relations.

22.3 Multistakeholder partnerships for climate change: purpose, approach and substance

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There has been widespread recent attention for climate change, most notably linked to ongoing attempts to realise a successor to the 1997 Kyoto Protocol, as discussed for example at the December 2007 conference in Bali. While policy-making efforts are still underway, the past few years have also seen a wave of voluntary initiatives at the local, national and international levels in order to start addressing the issue and build knowledge about possible solutions. This applies not only to those countries that have supported the Kyoto Protocol from the beginning, but also, and in some respects even more (if we for example consider state-level actions), to countries whose governments have been less enthusiastic about climate change policy such as the US (and, until recently, Australia). Especially in recent years, a range of voluntary collaborative arrangements between companies and other actors in government and society have emerged. These so-called multistakeholder partnerships (or cross-sector alliances) have received considerable attention in the field of (sustainable) development more generally (Selsky & Parker, 2005; Waddock, 1991), but only scarcely with regard to climate change – a gap that this paper aims to help address.

For companies, which face regulatory uncertainty and the complexities of finding an appropriate approach towards a complicated global issue that requires broad involvement, engagement with various stakeholder groups supplements the range of corporate activities already being undertaken (Hoffman, 2005; Kolk & Pinkse, 2005). Multistakeholder partnerships are flexible and seem to offer many advantages to companies. They can be a tool to manage the risks and exploit opportunities posed by climate change and to participate in setting a post-Kyoto agenda. Companies may improve the management of their climate impacts by getting access to other know-how and networks of expertise, which open avenues for innovation. Partnerships also offer ways to answer stakeholder demands, and improve companies' credibility, legitimacy and brand reputation, thus increasing awareness of and attractiveness to new and existing customers as well as employees (Elkington & Fennell, 1998; Rondinelli & London, 2003; Yaziji, 2004). In spite of the potentially important role of such collaborative efforts for climate change from various perspectives, there is not much insight into the extent to which companies engage in multistakeholder partnerships, how they function and with what focus. Such information seems to be necessary in order to be able to subsequently assess the pros and cons, and the contribution of multistakeholder partnerships as one of the policy modes for addressing climate change.

This paper examines the range of multistakeholder partnerships in which leading companies are involved to shed more light on this topic. By integrating literatures on corporate political behaviour, institutional entrepreneurship and strategic alliances, it will analyze three aspects of multistakeholder partnerships: their purpose, the approach chosen to achieve this purpose and the degree of substance of the activities employed as part of the partnership. With regard to the purpose we examine to what extent firms engage in partnerships to manage the political imperative of managing institutional pressure, the economic imperative of positioning in product markets, or a combination of both (Oliver, 1991; Salorio, Boddewyn, & Dahan, 2005). With regard to the approach we therefore differentiate between a technical approach of developing new technologies and/or implementing specific greenhouse gas reduction measures and an institutional approach of playing a role in climate change governance through legitimacy-seeking, rule-making and institution-building behaviour (Levy & Rothenberg, 2002; Scott, 1998). And finally, we shed light on the extent to which multistakeholder partnerships lead to substantive action, which goes beyond attracting media attention at their launch.

To analyze these aspects we have compiled a database using archival data from company reports, press releases, newspaper articles, and responses to the Carbon Disclosure Project. This database consists of a wide range of multistakeholder partnerships in which Global 500 companies have become engaged over the past few years. Based on an exploratory analysis of coding the qualitative data we collected, we will show what kinds of partnerships companies develop in response to climate change, how they try to find a balance between the political and economic imperative, and whether there is any substance in these partnerships and/or fit with their overall strategy. We question to what extent it can be expected that the approach towards multistakeholder partnerships followed by these companies might actually lead to any substantive activities that improve their impact on the global climate.

23.1 Progress Through Feedback – An Internet-based Personalised Monitoring System of Consumption Induced Greenhouse Gas Emissions with Rewards for the Goodies

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Introduction

An increasing number of consumers in Finland and elsewhere is concerned about climate change and state that they are willing to change their consumption patterns and habits, at least to some extent, with the aim to reduce greenhouse gas (GHG) emissions. (OECD, 2008; Ecorys, 2008). However, the actual behaviour of consumers shows that by and large environmentally inspired changes in consumption patterns do not amount to anything substantial.

In recent years in many countries, not the least in Europe, experiments have been carried out regarding the development of personal or household level carbon credit systems (Hongisto et al., 2009). Research indicates that positive feedback such as bonuses is – in principle – more effective than negative feedback such as sanctions and taxes (e.g. Andreoni, 1994), notably in less clear choice situations. There is a mounting evidence that the involvement of an informative interface towards the consumers can enhance the effectiveness of emission reduction policies for households (Throne-Holst et al., 2007; Jackson, 2005), notably with respect to those parts of household consumption where price signals have at best limited effect.

This paper draws heavily on literature research and empirical testing done in the project Climate Bonus[1], which is carried out by a team from five Finnish research institutes[2]. The key purpose of the whole project is to assess the possibilities and effectiveness of a combined feedback and bonus system for households, i.e. the Finnish Climate Bonus Pilot, which would incite them to consume in such a way that greenhouse gas emissions are reduced. The system could also incite retailers to offer a product portfolio that advances the choice for low GHG solutions by households. In order to enable a bonus system that functions properly, is credible and offers meaningful information to the consumers, the development of both an underlying information system and a web-interface to consumers is indispensable.

In this paper we examine the feedback and bonus system from the consumer's point of view. More in particular we are interested in the possibilities and effectiveness of inciting changes in consumer behaviour with the aim to reduce the embodied emissions of household consumption. We study consumers' experiences and judgements of the feedback and the bonus features respectively with the aim to infer whether such systems in principle can promote the desired behaviour and what features in the design and services provided seem to affect actual responsiveness and continuation of interest of consumers. The issues that receive special attention are usability, utility and accessibility of the system.

Testing the feedback and bonus system

In the Climate Bonus project a demo version was developed for an internet-based feedback and bonus system for households, including a version for PC's and an elementary version for mobile phones. The system allows households to monitor the development of their cumulative greenhouse gas emissions at various levels of aggregation of their purchases (i.e. several product groups) and to compare their scores with those of a peer group. The system also informs on acquired bonus points, which can be earned on the basis of a reduction of (calculated) embodied emissions of the cumulative aggregate purchases as compared to a pre-defined personalised reference level. The product groups now covered at a product level by the system include food-stuffs, home energy, transport fuels and transport services, with special focus on food-stuffs. In addition, some other groups of consumption are included just at a general product group level.

A first pilot was carried out in which approx. 35 consumers (households) from three different areas used the system to monitor the (cumulative) emission content of their purchases. Both the PC version and the mobile phone version were tested for a period of four weeks. During and after the trial the system was assessed by participants. People participated on a voluntary basis. A gift voucher was rewarded after the pilot.

Participants were asked to try out the different parts and functions of the system. They were also requested to purchase their food-stuffs from a selected number of supermarkets that were taking part in the pilot. A few key data per product, e.g. the type of product and its weight, were automatically registered by checking in a key card at the cash desk. The dedicated key card could only be used in designated supermarkets. In addition, participants could register themselves food-stuffs bought from other shops, purchases of residential energy and motor fuels, public transport trips, as well as expenditures to other main categories. Participants could follow the development of the cumulating emissions of their households, and in two areas also the accumulation of bonus points. On purpose one group was excluded from the bonus option to get indications about differential effect between feedback and feedback plus the option for bonuses.

During the pilot period participants were asked to fill out an electronic questionnaire concerning their experiences of the system. In addition, after the pilot period evaluative focus group discussions were arranged in each area. They were employed to gain contextual information on the experiences and views of the participants.

Preliminary results

The pilot produces information about consumers' different responses to a feedback and bonus system. It also reveals many aspects on its usability, utility and accessibility. Finally, it gives insights to the possibilities that this kind of system offers to decrease climate impacts of households, by identifying and pointing on the most harmful consumption patterns that each household and consumer had and rewarding with bonuses from the related 'climate-smart' choices.

The feedback also includes many proposals to develop the system and especially its web-interface, and these will be taken into account in possible forthcoming projects to develop the system further.

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[1] This project is still ongoing at the time of writing this abstract, but will be completed in May 2009.

[2] Government Institute for Economic Research VATT, Technical Research Centre of Finland VTT, Finnish Environmental Research Institute SYKE, MTT Agrifood Research, National Consumer Research Centre KTK

23.2 CO2 calculator

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Abstract:

Many countries are in the process of mapping their national CO_2 emissions, but only few have managed to produce an overall report at municipal level yet. Denmark, however, has succeeded in such a project. Using a new national IT-based calculation model, municipalities can calculate the extent of their CO_2 emissions and identify ways to reduce them.

This allows them to compare their CO_2 emissions between themselves, as well as with other municipalities in the EU.

"The Danish CO_2 calculation methodology for municipalities is based on EU and UN requirements for national emission reporting. The Danish CO_2 calculation methodology may serve as the missing benchmarking tool for municipalities within the EU and the UN," says Anne Mette R. von Benzon, project manager at COWI, the person behind the model.

In autumn 2007, the Danish Ministry of the Environment, the Ministry of Climate and Energy and Local Government Denmark (LGDK) decided to develop a nationally recognized methodology that would allow Danish municipalities to map CO_2 emissions on a uniform basis. The model take into account all municipal operations with a Green House Gas emission or which serve as a carbon sink i.e. heat and power production, transport, agricultural, forestry, land use, commercial energy use and citizens' use of energy and heating supplies, waste production and industrial processes with CO_2 emission (production of cement, glass and ceramic products) or emission of solvents.

The CO_2 calculator has also included a catalogue of tools and methods to reduce CO_2 emissions within areas such as waste, traffic, agriculture and nature and the program can calculate CO_2 reduction potentials for these mitigation measures.

The CO_2-calculator has been developed in a co-operation between the National Environmental Research Institute (NERI) and COWI.

23.3 The Environment Barometer with CO2-meter for entrepreneurs

Adriaan van Engelen and Marc Herberigs, Stimular Foundation, Rotterdam, the Netherlands

The Environmental Barometer with CO_2-meter for entrepreneurs,

A successful internet-tool for improving the environmental achievements of 800 companies in the Netherlands;

An initiative of Stimular Foundation.

Abstract:

The tool

At this moment the Environmental Barometer is used by more than 500 companies at over 800 locations. The number of users is growing rapidly. The tool was originally designed to encourage SME-companies to register their annual environmental performance and to encourage them to take environmental prevention actions and work on and sustainable development. Short after the introduction of the tool larger companies recognized the value of the Environmental Barometer as well, for monitoring environmental achievements and using the tool for internal en external communication.

The tool can be seen as a new language to communicate between companies and government or between companies and their suppliers and client about environmental issues and working on sustainability. Over 50.000 companies in the Netherlands are potential users who can profit from this tool. Also over one million comparable companies in Europe can improve there environmental management and easily save costs by using this tool.

Background

Since 1998 the Environmental Barometer has been developed and tested with success. Stimular developed the Environmental Barometer from the viewpoint of the entrepreneur, thus making it easy to understand and implement. Co-operation with over 75 sector organizations and local governments during the introduction stage has guaranteed widely acceptance.

At first Stimular Foundation offered the Environmental Barometer as an Excel-program to companies.

Since the release of the film “An Inconvenient Truth” by Al Gore the need for sustainable management and transparency has been growing rapidly. New policies for climate initiatives gave sustainable management an extra boost and industry, retail, NGO's and governmental organizations engaged in a dialogue about environmental issues and sustainable development.

In response to this development Stimular Foundation launched an internet version of the Environmental Barometer in 2007. This was a great improvement for further increasing the scale of use, with limited costs. Within the last two year the amount of barometers used, has risen to a total of 800 active barometers. In 2009 the 1000th user is expected. A variety of companies from different types of industries, retail, health care institutes, governmental organisations etc. use the barometer.

In March of 2008 the CO_2-meter, an extra tool in the Environmental Barometer, has been launched by our Prime Minister J.P Balkenende.

The Environment Barometer

The Environment Barometer is a flexible registration management system for companies. It enables the company to register quantitative information about energy, water, waste, hazardous waste, sewage, air-emissions and transport. The total environmental performance is expressed as one environmental score in a graph, a cost graph, and a set of EPI's (Environmental Performance Indicators). The CO_2-meter shows the CO_2 footprint in a graph of the company.

The Environmental Barometer encourages the company to work on environmental prevention. Many companies show, after using the barometer for 5 years, up to 50% decrease of their environmental impact, in combination with significant cost savings.

In May 2009 an English version of the barometer will be launched.

Involvement of local governments

On one hand local governments are involved as active users of the barometer (over 150 users) and on the other hand the local governments are the perfect stakeholder for setting up projects with local companies.

Based on policies combating climate change and encouraging environmental protection, the environmental department of local governments use the barometer in a wide range of projects. The economical departments see the barometer as a trigger for durable innovation. Companies active with sustainable management show interest in investment in sustainable buildings and installations at new industrial areas.

Advantages of the Environmental Barometer

The advantages of the Environmental Barometer for the business community:

a. Easy environmental registration;

b. A continuous stimulation for environmental innovation and cost savings;

c. Useful for internal communication and strategy development;

d. Useful for business tot business (benchmarking) and business to government communication;

e. Useful for benchmarking between different sections.

The advantages of projects with the barometer for the local government:

a. Easy insight into the environmental achievements of local companies;

b. Insight into the most serious environmental problems in the region, for setting priorities for new local policies;

c. An instrument for easily communicating the environmental achievements of companies to local residents or other stakeholders;

d. The projects encourage the participating companies to pursue a healthy economic development and at the same time decreasing their environmental impact.

Further approach

The next years the barometer will be extended with new modules. Benchmarks in different sectors will show the affectivity of national en European policy by the facts of registrations.

About Stimular Foundation, Stimulating Sustainable Management at SME

The business community and the governments of the Rotterdam region set up the Foundation Stimular in 1990. During the first ten years Stimular has successfully encouraged small and medium sized enterprises (SME) in the region to reduce waste and emissions, to save energy and to protect the environment. Since 2000 Stimular has extended its activities to include Sustainable Management for the SME.

Together with SME companies, Stimular develops new instruments for Sustainable Management. Research is mainly directed at the management of SME companies. In this way Stimular continues to build up knowledge and experience in the areas of waste and emission prevention, energy saving and environmental conservation.

Literature

www.Stimular.nl (in **dutch**)

www.milieubarometer.nl (in **dutch**)

34.1 Local Governance for Transition to Sustainable Society

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Local Governance for Transition to Sustainable Society

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University of Shiga Prefecture, Japan

1. Background

We are now facing to the risk of climate change and following ecological crisis. Such situation was made by human behaviors of seeking for partial solutions by individual actors in society. The governments also behave as individual not as public because public and private spheres were separated strictly within the modern legislations and the administration systems of the governments organized as bureaucratic sections segmented by their different functions. Thus nobody and no-organization has responsibility for total system of society.

However, human impacts on ecosystem invoked environmental problems everywhere and threaten human survival. In the case of Shiga, Japan we experienced the heavy lake water eutrophication and ecosystem destruction of Lake Biwa in 1970s and 1980s, people took notice that their lifestyle per se impacts to the lake ecosystem. They developed a movement for changing their daily washing to no detergent washing. This movement motivated the prefectural and central governments to legislate lake water pollution laws and bylaws and the chemical corporations to change their products from phosphoric detergent to no-phosphoric one. This is the case emergence of local governance for sustainable society. For challenging global warming we have to develop our global governance but we couldn't develop governance at global level immediately. If local governances grow in clusters, they will transform to global governance. Therefore it is important to develop local governance.

2. Local Community and Governance

As in the case of Lake Biwa environmental movement, local people act leading role for sustainable society. Because people have needs to survive, to bring up their children and to desire safety. They always struggle for satisfying their needs. But our global system doesn't exactly provide us necessary services. Most of the world population live in urban areas and there we have to get necessary goods and services through market and government at the expense of money for payment and tax. We couldn't get anything without money thus we get money through some employment in most cases. This is the prerequisite for survive. It becomes more unstable because the globalization of economy amplifies the fluctuation of boom and recession and then amplitude of price and employment change become larger. Our lives depend on the global fluctuation of economy more and more. We lose our foothold gradually in the local community.

Basically where people live, there are various needs for supporting their lives and if they could get ecosystem services there, they would produce and distribute products and manage local economy and ecology. If we could develop local systems for survive, we can change our economy more stable and our ecology more healthy and consequently reduce impacts toward global warming.

The eChi-San Chi-Shou' initiatives are now developing in Japan. eChi' means local, eSan' means production, and eShou' means consumption then this means local production and local consumption. Mainly those initiatives are leaded by producer groups. But principally the eChi-San Chi-Shou' should be initiated by consumer groups because it is just to choose ecological and healthy life-style. The springboard for the initiative is perceive that local products, especially local foods, local materials of house, are better for health, economy, society and ecology than remote products. For this purpose there is an attempt to manage local market in the ecovillage to exchange local products and wisdom to apply them.

3. Local Industry and Governance

In Japan big business provide goods and services to world market as well as most of the industrial countries. Supporting industries like as producing automobile parts or electronic components provide their products to big business. Thus most part of the business is exposed by fluctuation of the world market. Local industry produces not for local market but for global market as well. As a result local industry goes away from local market and local people. Local market is not big to sustain big industry but more stable than that of global. If Business depends on the big but unstable global market, its growth is high at one time and also its downfall is fast at another time.

There are two different drives as localization and globalization in business. We exemplify these two drives and declare pros and cons of localization and globalization drives from the perspectives of GDP effect, employment effect, market stability, trade network, material flow and CO_2 emission.

4. Local Corroboration for Governance

To change the economy to sustainable and stable one, both sides of economy, demand side and supply side, have to change together. Such change will never be induced within prevailing business and consumer's behaviors spontaneously. To induce the change, all stakeholders within the local economy involve its all processes and share a common vision. Local business groups, local consumer's groups, local governments, local environmental groups and other various local groups could access to the processes to change the economy. In Shiga we set up eEco-Economy Promotion Initiative' to promote the low carbon society with business groups, academic groups and local government. The targets of it are to promote spontaneous innovation for green economy and to implement local carbon offset conserving local ecosystems and activate local economy. Through experiences toward local governance we can draw out lessons.

34.2 The Neem Tree Industry – Empower the Poor with Green Technology in China

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The Neem Tree Industry – Empower the Poor with Green Technology in China

This paper analyzes the benefits and challenges of producing natural pesticide in China, using a case study of Nanjing Jiu Kang Biological Science and Technology Development Limited Company, with the purpose of exploring how the private sector can empower farmers with green technologies. The objective is to provide insights and learnings from the case example and make further suggestions for the whole pesticide industry. The findings are based on fieldwork conducted during February 2009 to April 2009, published government statistics, and analysis of secondary literature.[1]

Starting by analyzing industrial trends in China's pesticide and crop protection industries, this paper shows that the intensive appliance of chemical agricultural inputs in China has resulted in soil degradation. Furthermore, rapidly price increases in agricultural inputs led to the decrease of farmer's income. Addressing these two trends, Nanjing Jiu Kang Company became one of the pioneers in China's underdeveloped natural pesticide industry. Since 2001, Nanjing Jiu Kang Company developed new technologies to make natural pesticide from neem trees, which potentially will benefit both farmers and the environment. The case study illustrates that public-private partnerships were key for the company's early stage of R&D and for the commercialization of research findings in viable business models. With support from the Nanjing municipality government, Nanjing Jiu Kang was able to get sufficient loans to implement its ambitious innovation plans, and to considerably shorten the approval application process.

The new developed technology of Nanjing Jiu Kang provides multiple advantages to farmers. First, it offers natural pesticide as an alternative to current chemical pesticide. In addition, it offers additional income for farmers by providing the new possibility to plant neem trees, previously plant of little value. However, the case study further illustrates difficulties and challenges emerging throughout the project. Most critically, it is still uncertain whether the company's end product offers real benefits in the long term to farmers and the environment. Threats include, among others, price levels and effectiveness of natural pesticide. In response to these questions, this paper explores similar cases in other countries to highlight main barriers of development of natural pesticide and how they were overcome. The paper concludes with some suggestions on how to address current business threats for the Nanjing Jiu Kang Company specifically, and for China's natural pesticide industry in general.

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[1] The companies activities were first mentioned in a case example in Tsinghua 2008' case competition, funded by *Management Scientist (guanli xuejia)*, a Chinese management journal.

34.3 Networking and best practice of CP-projects in SMEs - Experiences from North Rhine-Westphalia, Germany

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Text Not Available.

34.4 *ECOPROFIT® - Model of preventive environmental management and sustainable development for companies and communities*

Christina Krenn and Johannes Fresner, STENUM GmbH, Graz, Austria

ECOPROFIT® - Model of preventive environmental management and sustainable development for companies and communities

DI (FH) Christina Krenn, Dr. Johannes Fresner

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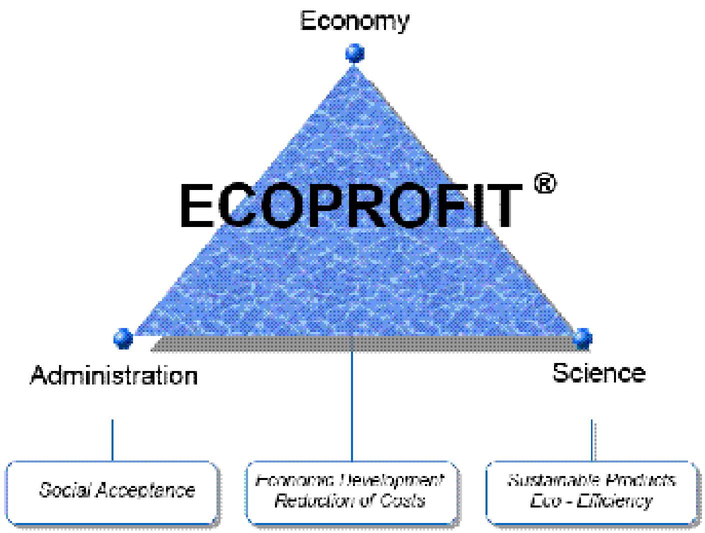
The approach of ECOPROFIT® was developed by STENUM from 1992 to 1993 on behalf of the City of Graz. The main objective is the development of process-oriented environmental management systems with the focus of waste reduction, efficient use of raw materials and the improvement of the energy efficiency of industrial activities. It offers individual consulting for businesses, collective work in workshops and cooperation with politicians, administrators and authorities. At the same time it helps to sensitise workforce and management for environmental problems caused by the enterprise including health and safety.



More than 150 companies in Graz representing different sectors of industry and hotels have taken part the programme from 1994 to 2008. Micro-enterprises with 5 employees as well as large companies of the automobile industry with more than 3000 employees have already joined the ECOPROFIT® beginners' programme. The model ECOPROFIT® with its networking among companies and municipalities can be seen as a constructive way of partnership and as an important contribution to the practical implementation of a sustainable economy.

Key benefits

ECOPROFIT® - advantages for companies include:

increase in production efficiency and reduction of costs due to a reduced consumption of raw material and energy reduction of costs due to smaller volumes of waste and emissions

transparent attribution of cost to material and energy flows

good overview of relevant laws and regulations for the company

awareness raising, motivation and generation of team spirit within the companies

joint training programs

support of the project by local authorities

presentation of companies and regions via international networks

certification as an "ECOPROFIT® company" and integration in common PR activities

facultative continuation to EMAS or ISO 14001:2004

ECOPROFIT® - advantages for authorities include

controlling-instrument for the implementation of sustainable structures

successful companies improve infrastructure and add to job security in a region

establishment of sustainable structures due to efficient support in economy

environmental relief and less expenses for bio-remediation

competitive advantages

improvement of the image of a region and promotion of tourism

higher quality of life for the inhabitants of cities and regions

support at the realisation of Local Agenda 21 objectives to reach the Kyoto target

support to implement the OECD guidelines

Implementation

The *ECOPROFIT® basic programme* consists of three elements:

- joint workshops,
- individual consulting, and
- the ECOPROFIT® award process.

Representatives of all participating companies, ideally 10 to 15, take part in each workshop. The topics of the workshops and typical interactive learning units are: An introduction to cleaner production, effective team work, material flow analysis, energy analysis, legal compliance, waste management, creativity and option finding, controlling, etc. In these workshops, the morning session always includes a "feed-back discussion", where the progress made since the last workshop is presented and discussed.

The implementation of CP options is considerably enhanced if additional individual consulting is done. In addition, the work in the workshop can be done much more effectively if it addresses the existing problems of the participating companies.

The final act of an ECOPROFIT® project is the award that is given to the companies by a City Mayor. This award is a strong sign of the official recognition by the city that the company's way of producing is environmental friendly and supported by the regional authorities. The award has to be applied for and renewed every year. For a company to receive this award, several criteria have to be fulfilled and checked by an independent commission.

The ECOPROFIT® Club program has been designed for companies who want to continue working together with other enterprises on their environmental performance after a successful

first ECOPROFIT® year. For Club companies, further inputs on new topics or on topics that need intense attention are offered. The Club is an important value added that supports the companies by combining the improvement in the environmental situation with measurable economic profits. Basically the Club consists of the following programme elements:

µ workshops, workgroups and learning from the best-in-class;

µ personalized and customized counselling;

µ preparing and presenting the award

Networks are designed to help to generate knowledge that will lead to innovations. The ECOPROFIT® network gives the participating companies, consultants, administrations and research institutes the chance of constructive networking and to benefit from various effects of synergy. Knowledge is generated by learning in the workshops and workgroups and by meetings and discussions among the Environmental Representatives.

Results

ECOPROFIT® companies actively drive and advance their sustainable development. The success of the ECOPROFIT® is reflected in the ecological and economic effects of implemented measures.

The ECOPROFIT® companies in the city of Graz could realize the following overall savings in the last 10 years:

µ Power fuels: 14,4 Mio. liters

µ Natural gas: 64,6 Mio. m≥

µ Electricity: 222.600 MWh

µ Water: 9,28 Mio. m≥

µ Residual waste: 21.000 t

µ CO_2-emission: 403.150 t

Figure 1 shows the decrease of the specific water consumption of a brewery since participating in the ECOPROFIT® project.

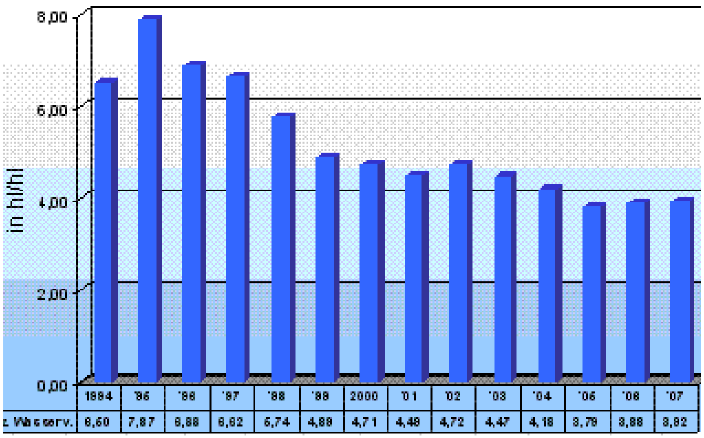


Figure 1: Specific water consumption of a brewery:

The following figure shows the results of the specific heat consumption of a brewery participating in the ECOPROFIT project since 1995:

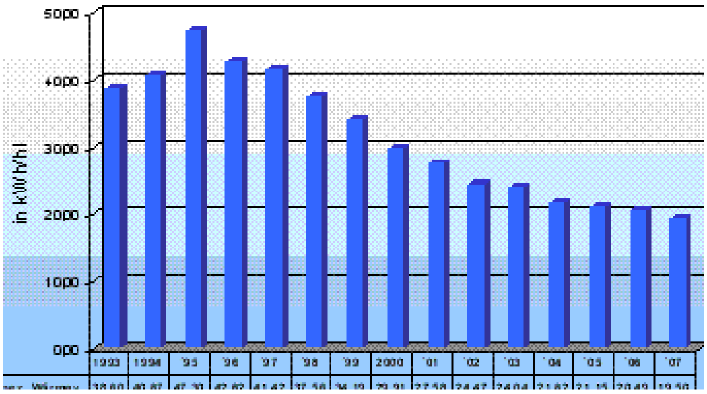


Figure 2: Specific heat consumption of a brewery

From **Ecoprofit** to ISO 14001:2004 or EMAS

With the realization of the ECOPROFIT® program the companies are well prepared for the implementation of an environmental management system according to ISO 14001:2004 or EMAS, because the method of ECOPROFIT® and the criteria's for the ECOPROFIT® award are similar to the guidelines of the environmental system.

34.5 NH Pollution Prevention Internship Program: A partnership to support Energy Efficiency, Building Benchmarking, and Climate Change

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Developing strong partnerships of academia and industry is an important element of achieving a strong educational program. These partnerships are mutually beneficial, and result in strong alliance between industry and academia.

Recognizing the importance of collaboration between companies, academia, and government to increase the level of awareness and acceptance of pollution prevention (P2), University of New Hampshire (UNH), the US Environmental Protection Agency (EPA), and the NH Department of Environmental Services (NH DES) formed **the ground-breaking NH Pollution Prevention Partnership (NHP3)** in 1993. The Partnership derives its strength from a diverse membership, with individuals representing industry, academia, consulting and law firms, local, state, and federal government, trade associations, banks, and many others. The Partnership initiated New England's first Pollution Prevention Internship (P2I) Program, offered through UNH. The primary objectives of P2I program are:

- To provide business and communities with well-developed options for cleaner production, pollution prevention, energy efficiency, climate change and sustainable development.
- To develop new information on pollution prevention, energy efficiency, and greenhouse gases that can be used to build educational modules and assist other business.
- To provide students with valuable opportunities to gain practical experience in cleaner technology, energy efficiency benchmarking and climate change.
- To create educational materials on the same topics

Engineering and Science students are teamed with interested companies and communities to work on P2 projects over the summer. To date, over 60 organizations have sponsored over 110 student interns. Through the on-site P2I projects, facilities and communities realized improved environmental performance, building benchmarking for energy use and efficiency, greenhouse gas emission reduction, and achieved considerable environmental and energy benefits. These include enhanced energy audits, reduced hazardous material use, decreased air emission and solid waste generation, improved energy efficiency, better water management and utilization, and lowered environmental liability and risk. Additional benefits include improved product quality, substantial cost savings, and improved public image. In fact, through our internship projects companies reported expected cost savings of over $3 million since the program was started in 1994.

P2I has been well received, and continues to be a success. Business and community participants became college extensions for the interns. Participating facilities realized that improved environmental performance and reduced carbon foot print often can be achieved best through process improvements that actually save money. The P2I Program was honored by several awards, the latest are the EPA Environmental Merit Award, and the National Most Valuable Pollution Prevention Program (MVP2) award.

35.1 Under-estimating the importance of consumer behaviour – the UK WEEE obligations

Cerys Ponting and Hazel Ann Nash, BRASS Research Centre, Cardiff University, Cardiff, United Kingdom

Waste electrical and electronic equipment (WEEE) was recognised as a priority waste stream by the European Community (EC). Consequently, Directive 2002/96/EC as amended by Directive 2003/109/EC on WEEE was adopted. As a member state of the EC, the UK is under a duty to comply with the requirements of a Directive (Article 249 Treaty of the EC). The first step to compliance is the transposition of the Directive's obligations into national legislation.

This paper examines the transposition of the WEEE Directive into UK law. In particular, the paper focuses on the extent to which the UK Government considered the role and responsibilities of consumers in meeting the obligations contained in the WEEE regulations. Drawing on empirical research with key stakeholders, the findings observe a disincentive amongst organisations to undertake WEEE prevention activities due to absence of consumer demand.

WEEE is growing at a rate of 3-5% per annum, approximately three times faster than other individual waste streams in the solid waste sector (Schwarzer et al., 2005). Rapid uptake of information technology, coupled with the advent of new design and technology in the electronic sector is causing the early obsolescence many electronic items used around the world today. For example the average lifespan of a new computer decreased from 4.5 years in 1992 to an estimated 2 years by 2005 and is further decreasing (Widmer et al., 2005). Studies have revealed that around 500m computers become obsolete in the USA alone between 1997 and 2006 (Yu et al., 2006). Similarly, over 130m mobile phones in the USA and over 105m mobile phones in Europe are discarded every year (Canning, 2006). In the UK, 6m electrical items are thrown away every year (Directgov, 2008).

Cooper (1994) observes that industrialised societies have become more acquisitive, individualistic and profligate - impacting product life. Therefore, typical design intentions are to meet regulations whilst making attractive, affordable products that perform well enough and last long enough to meet market expectations (McDonough, W & Braungart, M., 2002: 37). This throw away behaviour challenges waste minimisation and the ultimate goal of zero waste, since effective waste reduction depends upon longer lasting products (UK Government, 1994: 150-151). A report published by the Organisation for Economic Co-operation and Development underlines this: "*From a technical point of view there is no question that longer-lived appliances could be made. This is freely agreed upon by manufacturers of these products" (OECD, 1982:15).*

This paper draws on the findings of multi-phase empirical research undertaken with key UK stakeholders in 2006 and 2008. The research examines the UK's transposition of the WEEE Directive, its implications on consumers and the effectiveness of these obligations in encouraging integrated and sustainable design and production of electrical and electronic equipment. Findings suggest that to a great extent consumers were excluded from the transposition process. This has led to criticisms from a variety of stakeholders that the WEEE regulations are not effective in altering consumer behaviour and thus do not assist in achieving sustainable consumption and production (SCP).

The adopted methodology was a mixed methods approach, combining survey with qualitative semi-structured interviews. It was also a two phase approach, with the first phase undertaken in 2006 and the second phase in 2008.

The first phase consisted of a UK electronics industry survey, and was based on comprehensive desk research and prior research conducted by BRASS in the USA (Darby et al, 2004). The first phase survey found that just 20.2% of respondents considered that the WEEE obligations would be effective in preventing household electronic waste. Moreover, findings suggest that the transposition process was ineffective in raising consumer awareness of (i) EEE life cycle impacts & associated WEEE management issues, and (ii) the role of consumers in managing WEEE. In addition, semi-structured interviews were undertaken with UK Government Representatives, Trade Associations, Non-Governmental Organisations and selected industry representatives. From the interviews, there was concern among respondents about the role of the consumer in the WEEE process, and comments criticised the lack of awareness campaigns.

The second phase comprised a follow-up survey in autumn 2008. This survey focused on gathering information on experiences of businesses subsequent to implementing WEEE in the UK. This data enables a 'before and after' study. In this survey 60% either strongly disagreed or disagreed that UK WEEE regulations have been effective in raising consumer awareness of EEE life cycle impacts & associated WEEE management issues. Furthermore, a lack of consumer demand was considered to be a barrier in carrying out WEEE prevention and eco-design activities to over half the companies taking part in the survey.

In conclusion, legislative and policy measures intending to promote SCP through both a life cycle approach and producer responsibility obligations are unlikely to alter patterns of design, unless consumer influence and behaviour is recognised as an inextricable and significant influence. In this way, successful implementation of the WEEE Directive is embedded within the wider sustainable consumption debate.

The process of transposing the WEEE Directive into UK law provides useful lessons for the future. The lack of engagement with the public and the timing of publicity relating to WEEE requirements have undoubtedly inhibited public awareness of the obligations. There is a need for educating the consumer in the adverse environmental impacts of WEEE. The role of consumers should not be regarded as a secondary issue but of paramount importance if wasteful consumption of natural resources is ever going to be prevented.

Overall, it appears that there is some general hope that the WEEE obligations will, in the fullness of time, assist in changing consumption and waste disposal behaviours amongst the general UK population. This is only achievable through support and investment in consumer education and awareness that highlights the need to think carefully about environmental impacts of product purchase and product replacement. However, there is general pointing of fingers amongst stakeholders as to who is likely to be responsible and effective for such informational activities. Until this is resolved the WEEE obligations remain another retrospective waste management system.

35.2 *Integrated Product Policy in Portugal: the Start-IPP project*

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Integrated Product Policy in Portugal: the Start-IPP project

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Extended Abstract

1. Introduction

The Integrated Product Policy (IPP) is an initiative of the European Union with the purpose of reducing environmental impacts of products and services throughout their life-cycle, using management instruments which act in the production stage (development of products, manufacture and distribution/sales) as well as in the consumption of products (consumption patterns, markets). The implementation of the IPP intends to, in an efficient way, improve the environmental profile of products, with the acknowledgment and preference of the consumer.

2. Objectives

The **Start-IPP Project** (www.startipp.gr), financed by the LIFE Programme of the European Union was coordinated by CENDES – Centre for the Sustainable Entrepreneurial Development - of INETI, the Portuguese National Institute of Engineering, Technology and Innovation, in partnership with the Portuguese Agency for the Environment (APA), the Enterprise Association of the Lisbon Region (AERLIS), the companies Valdemar dos Santos, Lda., DURIT and MOLDIT and with the Greek partners: National Technical University of Athens (NTUA), EPTA, Ecological Recycling Society (ERS) and RAM-EUROPE.

The Project's main objective was to initiate the implementation of the Integrated Product Policy in Portugal and in Greece, through the development of a set of methodologies which allow the integration of environmental considerations along the life cycle of products e services, in Mediterranean countries, as well as the practical application of IPP instruments in which there is low experience.

With the great variety of products available in the market and the different actors involved along their life-cycle, it is not possible to apply just one policy measure. The IPP is thus a policy which will be integrated in already existing European policies and uses a set of tools, voluntary and mandatory, that can be used to achieve its goals. These include economic instruments, legislation, voluntary agreements, environmental management, ecologic labelling and eco-design.

This paper presents the IPP toolbox, an instrument developed to deal with this issue, and also the pilot projects implemented in several Portuguese companies.

3. IPP Toolbox

The objective of the IPP Toolbox is to find synergies between the IPP instruments and to identify the most feasible for a given organization, product or service. In the context of the IPP Toolbox, the IPP instruments are: Ecodesign, Cleaner Production, Environmental Management Systems, Environmental Labels, Environmental Product Declaration, Green Procurement, sustainability Reports and Self-declares Environmental Claims.

The IPP Toolbox has 4 parts:

ü Introduction, where the IPP Toolbox is described;

ü Set of questionnaires, where the potential of a given organization, product or service is evaluated for each of the IPP instruments;

ü Results obtained in the questionnaires and a set of recommendations for interpretation of those results;

ü Technical sheets on each of the IPP instruments.

4. Pilot Projects

In Portugal, pilot projects were implemented in 3 companies with the purpose of testing the IPP Toolbox and proceed to the practical application of the IPP instruments. A summary of the main findings is given below.

Valdemar dos Santos, Lda. –Portuguese Enterprise working in the field of ironwork, with work developed in the environment since 1980. The instrument developed, with scientific coordination from CENDES-INETI, was a Sustainability Report, elaborated bases on the G3 guidelines from *GRI – Global Reporting Initiative*. The first draft of the Sustainability Report is already available.

DURIT –Portuguese Enterprise producing highly resistant high precision parts with through pulverometry processes (ISO 9001). A Life Cycle Assessment was carried out, under the scientific coordination from CENDES-INETI, on one of their parts, being the greater impacts from the whole life cycle from energetic consumption and from certain auxiliary materials. During the brainstorming session, 26 improvement options came up. After selection and priority establishment in order to elaborate a Plano of Action, 9 of the options were classified for immediate implementation and 7 for short term implementation.

MOLDIT –Portuguese Enterprise producing moulds by plastic injection (ISO 9001). In this case, a Cleaner Production approach was undertaken, with scientific coordination from CENDES-INETI. After a brainstorming session with several elements of the enterprise, 38 improvement options were suggested for the most relevant environmental and economic impacts, being 13 established for immediate implementation and 12 for short term implementation.

5. Conclusions

The Start-IPP Project provided thus the bases for the introduction of the Integrated Product Policy and related policies in Portugal.

It was an innovative project that produced a valuable tool for future use by organizations: the IPP Toolbox (produced in CD-Rom format). This is a user-friendly tool, with the aim of explaining in a clear and concise way the Start-IPP project and its outcomes. The excellent results attained by the pilot projects also insure that the IPP, its related instruments and the IPP Toolbox developed during the project are effective and promising.

Following the project results, an Action Plan for Portugal was proposed to the Portuguese government, including recommendations on which kind of measures should be implemented in each type of organisations.

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35.3 Ecological Modernization and Environmental Innovation in the Public Transport Industry in Hong Kong and California: What Role for Environmental Regulation?

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Ecological Modernization and Environmental Innovation: What Role for Environmental Regulation?

This paper investigates from a firm level perspective the favourable innovation conditions that affect the adoption of EM-based Technological Environmental Innovation (TEI), and how different policy frameworks and instruments affect the conditions and outcomes of adoption. The TEI adaptation and diffusion are determined by economic condition (financial incentives), firm condition (technical/organizational capabilities and partnership) and stakeholder condition (attitudes and perception).

In the EM framework, market-based and voluntary measures have been accorded a significant role. However, these measures are sometimes inadequate to overcome various barriers. Incorporating findings from business and innovation economics, this paper reconsiders the possible role of regulation and advocates the strategic complementation of market-based and voluntary measures with environmental regulation (i.e. New Environmental Regulatory Approach (NERA)). With proper design and implementation, the regulatory threat can reinforce incentive-based/voluntary measures. The synergy can enhance the innovation conditions better. A proposed theoretical model illustrates how the policy process can iteratively improve the favourable innovation conditions to achieve EM-based TEI.

To illustrate the viability of the NERA, three empirical case studies are presented. The first case study on the adaptation of fuel cell buses in California confirms that regulations can stimulate the transport industry to search for innovative solutions. The second case study on the diffusion of Euro III/IV technology shows that the strategic coupling of regulations and other instruments, motivated bus operators in Hong Kong to adopt TEI. The third case study on the diesel-to-LPG taxi/PLB switch shows that regulatory pressure together with negotiation and incentives enhanced the innovation conditions among the operators. All these cases illustrate the viability and superiority of the NERA.

The study targets to provide new insights on the relevancy of the Eurocentric EM model in non-European contexts such as Hong Kong or California.

35.4 Post-2012 and Sectoral Approach

Yoon-Gih Ahn and Yoon-Jung Chin, Sustainability, Environment and Energy, POSCO Research Institute, Seoul, South Korea

In line with Bali Roadmap commitment at COP 13 on Dec. 15, '07, Post-2012 negotiation for GHGs reduction has been entered upon a new phase. All the countries should be taken efforts in order to reduce GHGs, and MRV (Measurable, Reportable, and Verifiable) has been newly chosen as one of reduce measures for Post-2012 mechanism. In particular, sectoral Approach was newly included in order to reduce GHGs of Post-2012 in Bali Roadmap, the interest and opinion of each country will sharpen conflict in the course of Post-2012 mechanism debate.
In order to discuss about Sectoral Approach, a wide range of meeting has been held in the world during 2008. The Major Economies Meeting has been held three times, in Hawaii on 28~29, January, in Paris on 14~16, April, and in Seoul on 20~23, June in 2008. And the AWG meeting of UNFCCC/COP has already dealt with the Sectoral Approach as a key agenda. In addition, the G8 summit in Hokkaido on July, '08 will deal with this approach with IEA's presentation of energy efficiency by sector. Considering these activities, sectoral approach will contribute to reduce GHGs as one of measures in Post-2012.
Hereupon, this paper aims at identifying versatile Sectoral Approaches and analyzing the core five Sectoral Approaches based on the competitiveness, CO©ü reduction capability, and common but differenciated efforts.

35.5 Accelerating the takeoff – Towards an Integrated eco-Innovation Policy

Jean-Roger M. G. Drèze, Directorate-General for Environment, Federal Public Service for Health and Environment, Brussels, Belgium

Accelerating the takeoff – Towards an Integrated eco-Innovation Policy

Exploring and developing the concept of an Integrated (eco)Innovation Policy (IIP) seems to become nowadays a momentum and probably a perequisite to accelerate the breakthrough towards a low-carbon economy.

The transition towards a low-carbon economy – and from there to the knowledge society – is a "narrow door" and a demanding challenge. Complex conditions are at stake addressing cultural, societal and ethical dimensions. However, two main drivers are commonly presented as prerequisites to proceed: a technological breakthrough (i.e. eco-innovations, technological and non-technological) and sustainable development strategies. Both are necessary. They should be integrated, mutually supportive and fine-tuned in order to create synergies, to develop a virtuous circle and deliver dividends in the economic, social and environmental dimensions.

Sustainable development policies and behaviors should indeed complement the uptake of eco-innovative technologies in order to mitigate rebound-effects induced by the de-materialization and de-carbonization of the productive capacities and by the resulting shift to more efficient production and consumption patterns.

However, the uptake of eco-innovation at a wartime speed remains a priority. Evidence shows that despite efforts undertaken by governments – with varying success and results – to accelerate the market uptake of environmental technologies, much remains to be done. Since the ETAP was launched in 2004, some Member States still experience (serious) delays in the technological transition to cleaner and leaner production patterns.

Some case studies can be exposed (the Belgium case is an example) explaining leads and lags in the adoption of eco-innovation by the market, especially by energy-intensive sectors such as transportation, household, building renovation and energy using & related products.

The paper shows that structural indicators and input-output matrix can partly explain obstacles and bottlenecks to the uptake of eco-innovation and to the adoption of environmental technologies by industry, SME and consumers. On the other hand, policy engineering might be improved. In 2001 the OECD *Environmental Strategy for the first Decade of the 21st Century* indicated that for global environmental concerns (and climate change is indeed a global concern) environmental policies should be more coherent and integrated in order to close the "implementation gap". Policies seem relevant, but results are hardly to observe.

Lack of integrated policies is obviously the other major obstacle in eco-innovation policies. Policy re-engineering might be adopted. In fact eco-innovation is embedded in the broader framework of innovation policies and obeys to the rationale "S" curve of innovation. All stages of the maturation and deployment are important and should be mutually supportive, as much as successive actors engaged. Nevertheless, public financing schemes and incentives remain fragmented, due to differentiated regional competences, institutional federalism or dedicated policies and measures.

Innovation policies are often seen as a succession of discontinuous stages, disclosing actors and markets: R&D, prototypes, demo, niches, early adopters, mass application, laggards and then saturation. However evidence shows that eco-innovation process is globally more complex. It must be addressed as a "life-cycle process" and designed through an integrated strategic and systemic approach. Moreover, the "eco" component introduces additional dimensions which clean the market. The introduction of sustainable production and consumption patterns also requires alternative management schemes.

Addressing the « implementation gap » the paper indicates that a close attention should be given to a life-cycle approach, going from research to product and from product to the market, through ETV, performance criteria, user-guidance (education), awareness raising, confidence building, purchasing power policies. This life-cycle vision, seen as a first basic building block, leads to an integrated innovation policy (IIP) approach.

However an IIP is much broader than the LCA dimension. The paper asks what is « eco-innovation » and compares the innovation cycle with the classical life-cycle of the Integrated Product Policy's cycle. The paper also analyses how to integrate supply- and demand-side dimensions. Might the process of technological innovation (explained by the "S" curve) be a process of dominance, even domination, using tactical options and strategies, in an overview of ownership share? In this case you can lose a battle but the important thing is to win the war. Alliance building and mitigation policies should be part of your dominance strategy.

Improving market uptake also requires a mix of various instruments. Consumers can dispose good eco-products but misuse them and get bad environmental performances. The way the product is used is as much important as the product itself. Developing user-guide and user's capability are necessary drivers. IIP should integrate regulation policies & education measures; market-based instruments & purchasing power policies; financing practices, ETVS & targeted performance criteria.

To conclude, the paper exposes some major building blocks of an Integrated eco-Innovation Policy (IIP):

- Adoption of a long term vision. Industry asks for long term benchmarks pertaining either to a Low-carbon economy, to a Recycling one or to a Knowledge economy.
- Definition of an (eco)innovation life-cycle. From the « S » curve to synergies among stages of the maturation and deployment processes.
- Designing non-technological approaches addressing local productive and trade profile.
- Integration of policies & actors. Develop policy-mix. Don't forget that policies are implemented by actors.
- Integration of instruments. Develop mix of instrument for each stage of the 'S' curve. Adopt fine tuned approaches. Develop structural indicators.
- Respond to people's cultural needs and purchasing power.

Jean-Roger Drèze

Federal department for Environment

35.6 From Cleaner Production to Carbon Management: Lessons from the implementation of cleaner production in China and its implications on the promotion of carbon management

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Cleaner Production (CP) is defined by the United Nations Environment Programme (UNEP) as "the continuous application of an integrated preventive environmental strategy to processes and products to reduce risks to humans and the environment." Since 1994, UNEP in cooperation with United Nations Industry Development Organization (UNIDO), started to promote the application of CP by enterprises in developing and transition countries by setting up National Cleaner Production Centers (NCPCs) and National Cleaner Production Programmes (NCPPs). The China National Cleaner Production Centre (CNCPC) under the State Environmental Protection Administration (SEPA) was established in December 1994 with an aim to promote China's CP research and consultation. In 1995, CNCPC launched the "Ten, One Hundred, One Thousand, Ten Thousand" programme which aimed to promote CP in 10 heavily polluting industrial sectors in 100 cities throughout China. The target is to have CP in place in 1000 enterprises and train 10000 people in CP concepts and methods. Since then, the Chinese government has seriously considered a cleaner production law, which signified its intention to shift way from traditional reliance on end-of-pipe solution as the principle environmental protection strategy. The Cleaner Production Law was later passed in the National People's Congress and came to effective in 2003.

By examining currently available literatures, this paper gives a brief overview of the Chinese national CP strategy, listing its ongoing efforts to promote CP, including partnership with international development assistance organizations to conduct demonstration projects and training courses, mandating proposed industrial development projects to include CP audits in the environmental impacts statements, establishment of a national environmental labelling program. CP in China has further been promoted by implementation of international treaty such as Montreal Protocol and supply chain pressure in international trade. Lessons on successes and failures of all these initiatives are drawn and factors that motivate or deter business from CP are identified.

Climate Change is currently the most critical global environmental issue. Governments have continuously been called to act before it is too late. As China is set to become the largest emitter of greenhouse gases in the very near future, China are under international pressure to control its greenhouse gas emissions, although at present, it is not required by Kyoto Protocol to reduce its emissions. Similar to CP, climate change initiatives in China is mainly a result of the central government's adoption and promotion. To demonstrate its commitment to climate change, china's Premier, Wen Jiabao, heads himself a task force to deal with energy efficiency and greenhouse gases emissions. In 2007, the central government has mandated key state-owned enterprises and provincial governors to pledge to achieve a 20% reduction of energy consumption (relative to economic output) over a period of five years. It is the strategy of the central government to implement such reduction through dominant state-owned enterprises.

The aim of this paper is to identify the similarities and differences between the existing climate-related initiatives in China with those related to CP. Perceptions of the businesses in China on both issues will be discussed. Lessons are to be drawn from the implementation of CP in China and this will have implications to the future development of Climate-related initiatives and the promotion of carbon management among Chinese business. Recommendations are given to suggest possible policy direction in the future.

46.1 Green Events in Austria - from the European Football Championship EURO 2008 to the FIS Alpine World Ski Championships 2013 in Schladming

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In terms of its effects upon the public, the UEFA EURO 2008™ was the largest sporting event that was ever held in either Austria or Switzerland. Austria and Switzerland have developed a joint sustainability strategy for UEFA EURO 2008™. The two host nations, Austria and Switzerland, in cooperation with UEFA and with the eight host cities: Basle, Berne, Geneva, Innsbruck, Klagenfurt, Salzburg, Vienna and Zurich conducted an overall evaluation and draw up a sustainability report on the implementation of the sustainability strategy.

The greatest environmental impact of a large event is in the transport area. For this reason, the host countries set themselves ambitious targets for the involvement of public transport. Climate protection was of the utmost importance in the area of energy. As an example, a large part of the power consumption was supplied by renewable sources of a high ecological standard (green electricity). The saving of resources stood uppermost in the area of waste management: Priority was given to avoiding waste through the use of returnable cups, the application of the "wrap in" campaign and the foregoing of the distribution of advertising materials. In order to guarantee the recycling of materials, PET bottles and aluminium cans were sorted and recycled. The EURO 2008 collection and return quotas were good, and both the returnable cups and waste separation concepts were well accepted and implemented by the visitors.

As the most important measure for the reduction of waste, the sustainability strategy recommended the use of returnable cups or of ecologically comparable beverage containers. The ecological superiority of returnable cups over disposable cups – even under the specific conditions of the EURO 2008 – was clearly proven by the trinational ecological balance created in assignment by the environmental ministries of Austria, Germany and Switzerland, as well as various states, cantons and cities. The use of returnable cups also essentially reduced the littering problem – for the incentive to return cups was made more attractive through the offer of a deposit.

To ensure the material cycle, caterers collected and sorted PET bottles in their backstage areas, and partly also aluminium cans, and took them for recycling. In most of the host city fan zones and fan miles waste was collected and sorted. Instead, drinking cups were made refundable and then collected and sorted by type in the backstage areas.

46.2 Sustainability Measurement for Sports and Cultural Events

Calvin Jones, Andrea Collins and Max Munday, ESRC BRASS Centre, Cardiff University, Cardiff, United Kingdom

The environmental impacts of major sporting and cultural events have attracted increased policy and media attention, with the realisation that larger events can have significant implications for climate change emissions, resource use and local landscapes. The mitigation of such effects is not straightforward however, with event organises often lacking appropriate management skills, measurement metrics and, indeed the resources and time to develop these elements. This paper reports upon a project sponsored by UK Sport which piloted a number of environmental impact measurement tools and options across a number of events in 2008. The project is intended to develop a guide for event organisers such that they can engage proactively with the environmental (and indeed social) context within which their events operate, thus minimising negative environmental impacts whilst seizing any opportunities for events to develop positive impacts.

46.3 Carbon Offset Schemes for Aviation: Inconsistent Supply and Weak Demand, What Hope for the Future?

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Extended Abstract

Carbon offsetting is a mechanism for compensating for greenhouse gas emissions generated by a particular activity by paying for equivalent emissions savings or reductions to be made elsewhere in the economy. This paper presents the findings of an OMEGA funded study[1]designed to clarify the role, effectiveness and credibility of offsetting for air travel and to investigate attitudes towards the offset concept amongst airline passengers. It involved two primary empirical activities; a review of carbon offset providers and a survey of passengers travelling through Manchester Airport.**Review of offset Providers**

The review of voluntary offset providers describes and evaluates the key elements and structure of such schemes. Web sites of 42 online providers of aviation offset services were examined in November 2007. This revealed:

· Significant differences in the cost charged for offsetting the same flight on different web sites (the cost of offsetting London (LHR) to Paris (CDG) varied between £0.31 and £12.95).
· While offset providers demonstrated consistency in the calculation of flight distances, they differed significantly in the sophistication of their assumptions and emissions calculations and not all provided details of how costs were estimated.
· Variability in the unit cost of carbon savings (this ranged from £2.00/tCO$_2$e to £18.00/tCO$_2$), which significantly affected in the cost to offset a given flight.
· Offset products available on different web sites varied considerably in terms of transparency of systems, the quality of accounting, risk of double accounting and 'leakage' (emissions displaced to other activities), and the capacity to confirm 'additionality'.
· Efforts are separately underway at a UK level (through DEFRA) and at an international level (ICAO) to standardise methods of calculating emissions from flights to be offset and to achieve verification of offset products themselves. Nonetheless, convergence in methodologies and greater consistency in assurance procedures is still needed to raise confidence levels.
· The process of purchasing offsets creates an opportunity for providers to inform consumers and thereby promote attitudinal change and increase public engagement with the climate change challenge. There was considerable variability in the extent to which this opportunity was exploited by different providers.

Survey of Passenger Attitudes to Offset Provision

A questionnaire was designed in consultation with stakeholders from government, industry, NGOs and research institutions and a survey of 487 passengers undertaken at Manchester Airport in January and February 2008.

The principle results of the survey indicated that:

· Almost 8 out of 10 people questioned had previously heard of offsetting but less than half were aware that such schemes could be used to reduce the climate impacts of their flight.

· While more than three quarters of passengers accept that air transport contributes to climate change, relatively few (less than 10 per cent) are willing currently to change their behaviour about flying or to purchase offsetting.

· One reason for this lack of conversion between attitudes and behaviour may be that many passengers believe that they are not primarily responsible for the climate impacts of their flights. They look instead to government or to airlines to address those impacts.
· Low uptake of offset schemes arises also from lack of awareness of their existence and little understanding of their purpose or how they operate.
· The preferences expressed by respondents suggest that the uptake of offsetting schemes could be increased by ensuring that their benefits are transparent and well publicised, that they support both projects in developing countries and projects in the UK local to the travellers and that they meet UN quality standards.
· A small minority of passengers (less than 10 per cent) are strongly supportive of efforts to mitigate the climate impacts of flying.
· These 'lead-edge' aviation offset consumers were characterised as expressing strong agreement with statements that climate change is a genuine threat, air transport has an influence on climate, individuals can limit the impact of air transport on climate through their actions, and that individual passengers are primarily responsible for offsetting the climate impacts of flying.
· A much larger proportion of passengers (of the order of about one third of all passengers surveyed) appear willing to make some contribution to climate mitigation; however, dramatically improved consumer confidence (particularly about guaranteed benefits) is required if passenger uptake is to be significantly increased.
· Many passengers are concerned at the lack of standardisation in carbon markets and in institutional (government and industry) responses to climate change.

Conclusions

Offsets can be purchased by individuals wishing to compensate for their choices and in this regard they represent one of the few opportunities for immediate and direct action to minimise climate change by the consumers of products and services. This is important in respect of air transport because of the magnitude of climate change emissions associated with flights and because, there is often no suitable low carbon alternative to aviation for long distance high speed travel.

Given that offset schemes are currently voluntary, if a greater uptake is to be achieved then much more needs to be done to raise awareness of the existence and benefits of such schemes.

Standardisation of methods of calculating the CO_2e emissions from particular flights and of emissions savings made by particular offset schemes is necessary to minimise confusion and mistrust and build the credibility of the offset industry amongst consumers.

This paper identifies a core of passengers who wish to offset the full climate change emissions of their flights but a much larger proportion who wish simply to make a compensatory payment. Clear and transparent systems catering for different customer demands are therefore required. This can extend to providing details of the social co-benefits that can arise from particular offset activities that may make them more attractive to consumers.

Finally, the process of engagement with the consumer provides an opportunity for awareness building that can further influence attitudinal change that can support the move towards a low carbon society.

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[1] Omega is UK Government funded £5M partnership of 9 UK universities developing and transferring knowledge to support aviation sector and Government work to strengthen the sustainability performance of air transport.

46.4 Puttin' on the Ritz – but what are the emissions?

Anne Rønning and Andreas Brekke, Ostfold Research, Kråkerøy, Norway

Introduction

How large are the greenhouse gas (GHG) emissions from running a hotel? And what about the emissions from all the hotels in a hotel chain in Scandinavia? A pilot project was performed in 2008 to answer such questions and assemble a GHG account for Choice Hotels Scandinavia. This paper presents how the account was made and the results from the undertaking.

Considering the immaturity of both GHG accounting and environmental assessments in the service sector, the paper also aspires to contribute to methods development and standardisation with regard to GHG accounting. There are two initiatives in particular directed toward harmonisation of models and methods for calculating GHG emissions, namely Global Reporting Initiative (Fransen et al., 2003) and the work of British Standards on the PAS 2050 (BSI, 2008). The method employed for the specific case presented here is compared and contrasted with the recommendations from these two initiatives. The paper concludes with methodological considerations for GHG accounting in general and in particular when applied for services and not products.

Methodology

Several efforts addressing issues of methodology for GHG accounting from products and services have been presented during the last decade, e.g. by UNEP/SETAC, BSI/Carbon Trust, ISO, the Swedish Environmental Management Council and WRI/WBCSD. One common feature in these efforts is that principles of life cycle assessment (LCA) methodology are being employed, recognising the need to consider the entire life cycle of products or service and also to relate the GHG account to the specific function(s) delivered by the product or service under scrutiny.

One important reason for the evolvement of GHG accounting approaches has been the recognition that emissions from enterprises are not limited to the manufacturing of products, but from support functions as sales management, marketing, and purchasing of goods and services as well. Thus, activities related to transportation of goods and people, production, and energy use should be considered as equally important areas in GHG accounting. This implicates an extension of systems boundaries compared to those generally being adapted in environmental accounting.

A challenge in making an account of an enterprise's emissions is that one needs to consider emissions in two dimensions, as shown in Figure 1.

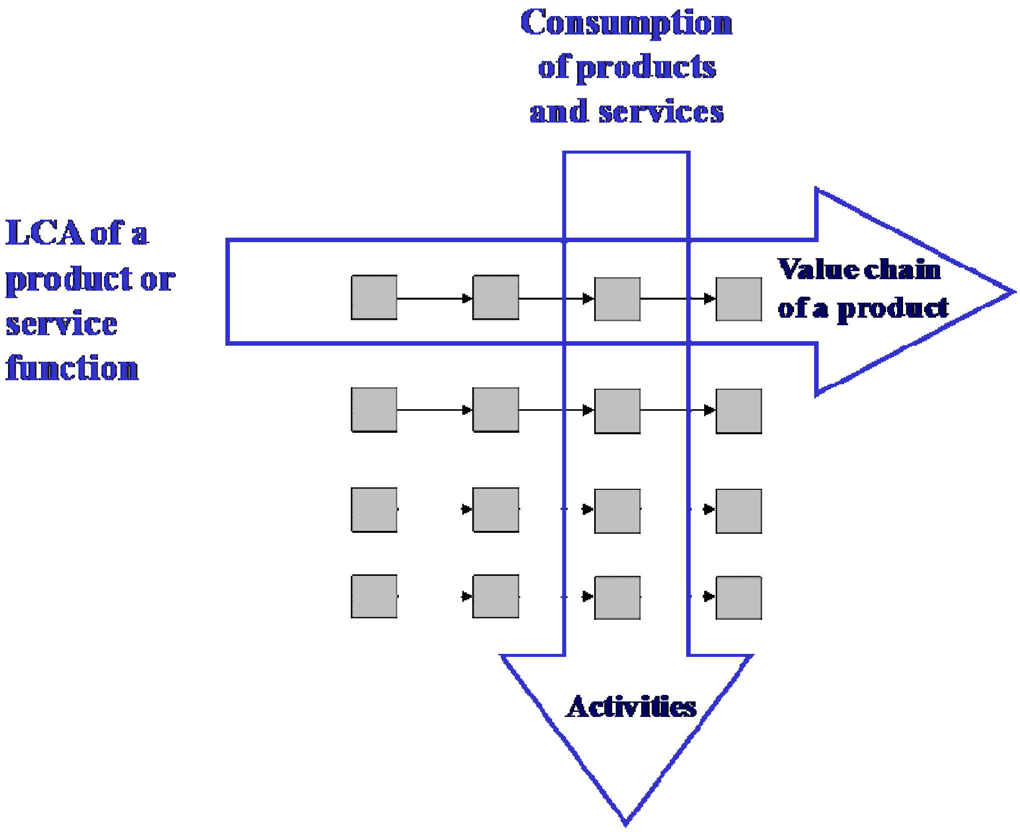

Figure 1 An enterprise's contribution of emissions in two dimensions.

Hence, the company is responsible for all direct emissions from the use of materials or energy as well as the emissions associated with having them produced or handled after end-of-useful-life given in the figure as:

1. The value chain related to the different products or services consumed by the company (horizontal arrow)

2. The activities the company performs to fulfill its function(s)/purpose(s) (vertical arrow)

Figure 2 below illustrates which products and materials that have been included and excluded in the specific analysis of GHG emissions from Choice Hotels Scandinavia. System boundaries are further elaborated in the final paper and methodological decisions discussed in relation to the PAS and GRI methodologies.

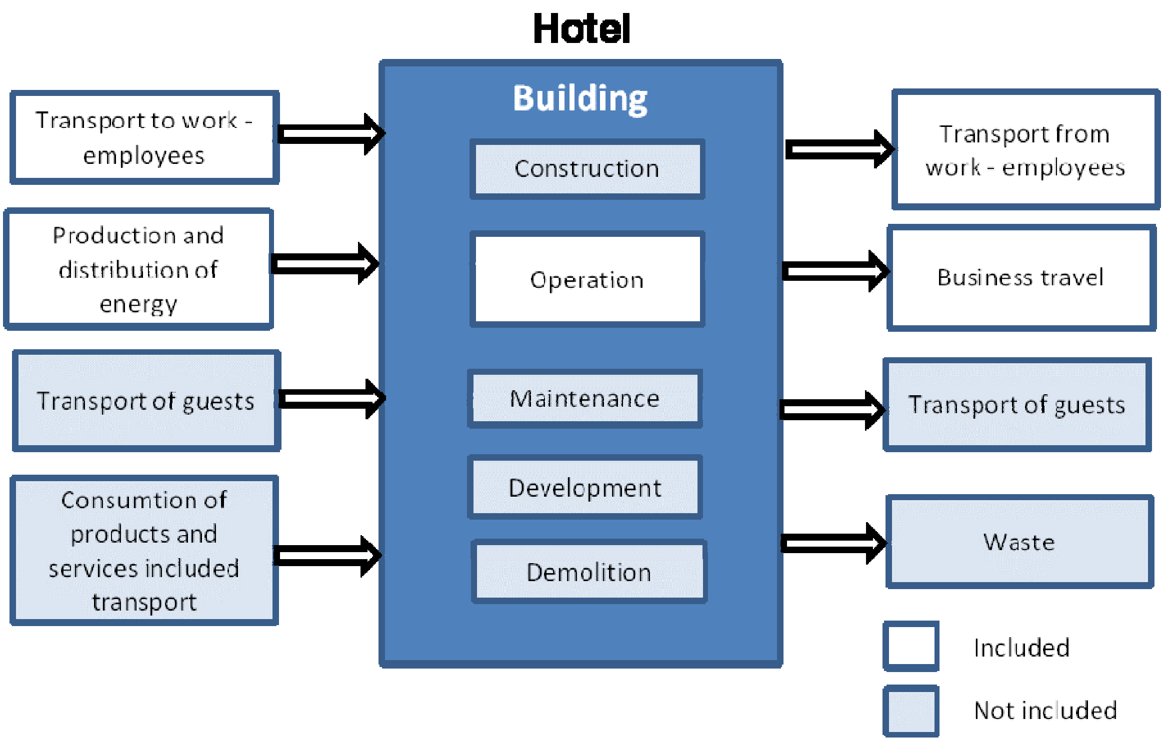

Figure 2 Categories/activities included in the GHG account for hotels.

Analysing the GHG emissions from hotels services may be particularly troublesome as hotels offer activities and services in addition to the traditional overnight stays. Thus, these additional functions of hotels must be included if hotels are compared to other hotels or with other ways to offer the same activities and services.

Other difficulties in producing GHG accounts arise in the actual collection of consumption data and the modeling of emissions from the consumption. Limited availability of data may be one reason for an inability in overcoming narrow system boundaries.

The paper presents which data are used and how they are collected for the specific case from the hotel industry.

Results

The total climate account for the 149 hotels in the Choice Hotels Scandinavia shows emissions of appr. 20.000 tonnes CO_2 equivalents. Energy use from operating buildings constitutes appr. 13.500 tonnes CO_2 equivalents. Employees' transportation to/from work places comprise appr. 5.500 CO_2 equivalents, and contributions from business travels appr. 800 tonnes CO_2 equivalents.

To compensate for differences in size, capacity utilization and functionality of the hotels, specific indicators for energy use and transportation were developed and shown in the paper.

Conclusions

The results from this project shows that it is possible to work out a climate account for Choice Hotels Scandinavia. Even if the account does not include all activities and aspects presented above (fig. 2) it still is a useful foundation for further elaboration of the methodology. The results are based upon validated data to indicate the hotel chain's total climate gas emissions and to identify areas where actions should be taken in order to reduce emissions substantially.

Climate accounts are still in an early phase of development as an environmental management instrument and the case study presented here is seen both as an input to the general discussion on the relevance and usefulness of the approach, and also as an contribution to the understanding of the specific environmental challenges facing the hotel business.

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46.5 Actions at a hotel chain

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Hotel companies are normally not associated with bad environmental behaviour. Nevertheless analyses show that CO_2 emissions from tourism ought to be heavily reduced while at the same time the total tourism volume is constantly increasing. This is the story of how Scandic took the leadership in sustainability within the hotel industry already in the early 90's, what measures the company has taken – on CO_2 emissions and in other areas, how team members were involved, about the results and learning points.

58.1 Large scale food service spaces as a messenger for sustainable food consumption strategies

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Text Not Available.

58.2 Organic, local and vegetable based food sourcing as a sustainable strategy – what data are available?

Michael S. Jørgensen, Technical University of Denmark

The paper describes at a conceptual level the climate aspects of food production and consumption and introduces different strategies, which can reduce the climate impact from food in general and especially at food events – without increasing other environmental impacts of food production and consumption. As part of discussing these topics the paper describes available data. Besides climate impact, impact on land use, biodiversity, chemical emissions, nutrient flows and ground water levels are important environmental impacts related to food production and consumption.

All parts of the life cycle of a food product from fishing and farming through processing and distribution and until the final processing and consumption have climate impacts and also other environmental impacts. The size of the impacts depends on the effectiveness of the processes in the different parts of the life cycle, including the wastage generated. The effectiveness can be seen as impacts per kilogram food or per unit if nutrients. The climate impact depends on the food products which are produced, because there are big differences among the climate impact from different types of food. Especially animal food has a high climate impact with big differences among different types of meat (due to the production of fertilizer for fodder production and for ruminant the evaporation of methane from the digestion) and among different types of fish (depending on the distance of sail per kilogram of fish). Also vegetables grown in greenhouses heated by fossil fuel have a high climate impact. A so-called CO_2 food pyramid has been developed as a simple tool for decision about what food products to choose for a meal. The pyramid is based on life cycle based data about 150 food products from a Swedish project managed by Carlsson-Kanyama. A food event related meal like a hot dog has very different climate impact depending on the type of sausage. Soy protein: 80 gram CO_2-equivalentes. Chicken: 150 CO_2-equivalentes. Pork: 250 gram CO_2-equivalentes. Lamb: 670 gram CO_2-equivalentes. For the Danish average diet 50% of the climate impact comes from animal products (dairy products and different types of meat and meat products).

The importance of land use can be seen from the fact that 62% of the Danish land is cultivated, whereof 80% are used for the growing of animal fodder. The importance of land use in other countries is seen from the fact that Denmark is imported 25% of its animal fodder, especially soy protein. The climate impact from soy protein may be very high since this type of fodder when grown in South America often is grown on land that earlier was covered with trees or other types of plants. The clearing of the land causes a substantial climate impact for many years. The climate impacts from agriculture can be divided into energy-related impacts covering the use of fossil fuels for vehicles and machines (15% of the climate impact) and non-energy related emissions, which are related to the chemical processes in the soil from application of fertilizer and manure, oxidation of carbon in the soil etc. (85%). These types of impacts vary a lot from farm to farm, depending on the type of agriculture and the local farm management, which implies that food procurement for events could focus on these aspects. Organic farming has a number of advantages related to nature, environment and health, compared to conventional agriculture, to bigger diversity, the use of organic manure, lower nitrogen surplus in the soil etc. The climate impact of organic food compared to conventional food differs depending on the type of food. The climate impact of greenhouse vegetables are bigger for organic vegetables due to lower yield per m^2 greenhouse, while the impact of organic pork is lower due to lower nitrogen surplus and thereby less laughter gas product gas emission from the growing of fodder for the pigs. The type of soil influences also the climate impact. Agriculture on drained soil contributes more to climate impact because of the oxidation of the carbon in the soil into carbon dioxide and at the same a low yield on this type of soil.

Analyses of the climate impact from transportation of food shows compares to the climate impact of the food product itself show that for fruit the impact from transportation maybe 50% of overseas fruit, while for animal products the transportation may contribute around 15%. This implies that local products have a lower climate impact compared to products transportation a long distance. However, local vegetables grown in greenhouses outside the season has a higher impact compared to products grown in areas where greenhouses are not needed.

An assessment of household food waste from the UK shows that 20% of the food ends as waste (not including the peels from carrots etc.). Half of the food waste is processed food products, while the other 50% are food that has not been processed yet.

Based on the available data for climate impact a climate strategy for food at events should be based on: a substantial amount of vegetable products and a limited amount of animal products, a strategy for reduction of the food waste, products from organic agriculture and/or from conventional farms with a low surplus of nutrients and local products grown within the seasons. Greenhouses should be heated with renewable energy.

58.3 Does festival musical encounters go hand in hand with organic style food service ? – casefindings from Øya music festival

G. Roos

Text Not Available.

58.4 Sustainable foods at the climate summit 2009 in Copenhagen – how can ambitions be met in real life foodservice?

B. Brorson

Text Not Available.

59.1 Study on the Coal Resources Utilization Policy in China: A case study of coal companies in China

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As one of the developing countries, although the per-capita level in China is only 33% of that of OECD (Organization for Economic Co-operation and Development) countries and the energy consumption per unit of GDP was lowered by 47 per cent between 1991 and 2005, the greenhouse gas emissions from fossil sources have increased hugely since the late 20th century in China. Coal has always been the most important energy in China for a long history. The annually amount of the coal exploitation in China is the largest as well as its consumption all over the world, which respectively accounts for 39.4% and 38.6% of the total amount all over the world. So the positive measures adopted by the coal industry and enterprises as well as the treatment and ways by which the coal and its downstream process such as coal-fired power plants are consumed in China will be very important for the carbon emission reduction, not only for China, but also for the Asia even the global climate with its largest consumption amount. Under that background, China has put climate change at the heart of its energy policies. This study takes one of the largest coal companies as the case study. By comparing the different develop and management modes, the paper shows how national and regional policies, technology and more rational plan for exploiting and consume impact the carbon emission and ultimately influence the regional climate.

59.2 CLIMATE Change: Strengthening Mitigation and Adaptation IN SOUTH Africa

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CLIMATE CHANGE: STRENGTHENING MITIGATION AND ADAPTATION IN SOUTH AFRICA

Dr. Kola Odeku and Prof. Edson Meyer

Abstract

The impacts of climate change are now visible all over the world. Scientific evidence had confirmed that African continent would be worst hit. South Africa, a developing country in Africa is the most industrialized and electrified, its economic growth has clearly brought substantial benefits to the poor. However, this would not have been possible without increase access to energy consumption. Energy is sourced mainly from coal and it is used to power the industry and generate electricity. This activity ranked South Africa as the highest emitter of carbon dioxide in African continent. The immediate and long-term impacts of climate change are threatening social and economic progress. Such impacts are already being felt in a number of real and recognizable ways in the country. Climate change is now affecting the wild life, ecosystem, agriculture and there is sea level rise around coast of Cape Town and other predicted impacts. It is against this back drop that bold steps are now being taken to strengthening mitigation and adaptation in order to evolve long-term framework to promote the transition to lower-carbon economies needed to address global climate change. Coming up with policies to tackle change is important. But making them a reality through implementation and accountability is what counts. it is in this regard that South African government is vigorously implementing climate change adaptation and mitigation through policy, legal, institutional interventions.

Consequently, the government is now currently promoting the use of renewable energy and energy efficiency. There is now a White Paper on renewable energy which sets an ambitious programme for the use of renewable energy such as biomass, solar system, small hydro generator. Energy from these sources are clean, accessible, affordable and do not emit carbon dioxide. Also, the use of energy efficiently is vigorously being promoted. Towards this end, the government has consistently promoting energy efficiency technologies particular in the industry, also different lighting bulbs that are efficient are been promoted in the household. The government is doing everything possible, especially through monitoring to ensure that all the measures put in place are followed toward realisation of clean environment. Similarly, different measures are being put in place to adapt to impacts of climate change. Towards this end, there have been massive networking between South Africa and a lot of Scientists and Engineers on training of know-how to be able adjust to prompt impacts of climate change in case it manifest. Government has now come to recognize the negative consequences of decades of a "grow now, clean up later" approach, steps are also being taken to address air, water, and land pollution and to manage the natural resources more sustainably. Governments now want to ensure that economic growth, resource management, and climate change mitigation and adaptation can all happen at the same time.

59.3 Diffusion of solar solution in developing countries – focus group study in Ghana

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The role of renewable energy has gained much attention in modern trend of reversing the global energy crisis especially in developing countries. Renewable energy systems are methods of harnessing energy for human consumption in a way that the source of such energy is not depleted over time as compared to fossil fuel which is currently being threatened due to insatiable global consumption patterns (IEA, 2002). While the 'greenness' of renewable energy plays a major role in developed countries making it a preferred choice, it is quite unclear if developing countries resort to renewable energy for the same purpose.

A study on the energy system in Ghana shows that many would prefer an alternative source of energy in Ghana. These specific problems and many more have created serious energy crisis resulting in decades of high incidents of unauthorized and frequent power outages as well as regulated load shedding exercises (the rationing of electricity by geographic location, consumption capacity and density lasting between 12 – 48 hours). This particular phenomenon amongst other factors in turn has lead to high incidences of low productivity, low development and slow growth of the country's economy (Dovi, 2007 and Mensah-Biney, 2007). This nature of power rationing has lead to many industries; commercial and domestic consumers opt for secondary sources of power like generators which comes with its own problem like environmental pollution and high cost of fuel.

There is the need for increase in the energy capacity of developing economies. For instance in Ghana, the Ministry of Energy explained in the *Policy Framework and Guide for Development of Independent Power Producer* that the demand for energy in Ghana has increased in the past 10 years to about 5% per year representing capacity addition requirements of about 50MW – 100MW per annum. Since 2006 there has been promises from the government on measures they intend to put in place to alleviate the energy crisis (New Africa, 2007).

Meanwhile, solar solution as an alternative source of energy was hardly identified as viable option due to lack of adequate information and knowledge. A focus group study points out that the rate of awareness of solar energy among Ghanaians is very low. It was observed also that, the public seems to hardly understand the real components that make up a complete solar-solution which include: panels, charge controllers, battery and in some case inverters. It was established further in the study that, solar panels are also perceived to be monstrous and bulky making potential customers wonder if their properties would not be defaced.

Results from the focus group session of sampled respondents selected from different regions of Ghana revealed that many consider solar energy as best alternative due to the degree of awareness created during the interviewing session. However; the problem was identified to be a matter of accessibility and financing. For those who claimed that they could afford, it was a matter of 'accessibility' of the solar products on the market. This raises the need for further study in ascertaining the right segments for the diffusion of solar solution. Identified segments include: **standalone** (*the solely use of renewable energy solution, especially for people without access to any form of conventional energy*), **backup** (*the use of renewable energy solution in case of a black or brown out*) or a **hybrid system** (*where specific household or corporate systems could be connected to a renewable energy system*). Findings however, point out that this system would be of help to both industries and domestic use (Aitken 2003:33, 35).

Meanwhile, an attempt to establish the financing options available to users pointed out that, financing as a problem was insignificant. The main problem lies in having a viable economic framework from which financial institutions will design a realistic pay-back time. Existing financial structure identified in

Ghana includes: individual and corporate loan systems for investments, like cars, housing and start-up businesses. This system makes it possible for financing of alternative solar solutions.

Various forms of education to be used include: seminars, workshops, posters, televised demonstrations, radio and phone-in programs, classroom lectures amongst others. However, it was further established that amongst others, this study is a first attempt in educating and repositioning solar solutions to Ghanaians as a means of attaining an economic sustainability, development and growth (Holm 2005:13).

Keywords: renewable energy, greenness, financing, accessibility, developing countries, Ghana.

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59.4 Technology Transfer Projects and Institutional Development in Developing States: Success or Failure of Solar Home Systems in Rural Africa

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International environmental law documents call for technology and knowledge transfer from developed States to developing States as one of the measures to mitigate climate change. There are endless possibilities for different technology transfer projects, from building and setting up wind energy centrals to enabling rural electrification with the use of solar power. However, the projects established under these measures all focus extensively on the amount of greenhouse gas emissions reduced. It is obvious that a technology transfer project based on acquiring energy from solar power will be unsuccessful in a developing State where there is little sun, since the reduction of emissions will be marginal. Nonetheless, it is generally far less clear that such a project might be equally unsuccessful in a developing State where there is an abundance of sun all year round and the greenhouse gas emission reductions from the project would be extensive.

This research paper demonstrates that while the amount of greenhouse gas emissions reduced is the basic element for approval of a project, the success of a project in a developing State lies in the project's conformity with the institutional system in that State. The findings are based on a comparative research of two different models of solar home systems [hereafter SHS] in rural areas of two African States with different institutional development.

Electrification has often been promoted as one of the backbones of economic development in Africa, as it brings many benefits to the population of developing countries. From the literature on rural electrification, the SHS seem to be preferred over the other insular sources of electricity, with several other advantages, not just the reduction of greenhouse gas emissions. Thus today more than 600,000 SHS have been installed in the developing world. In Africa there are currently two different user models of SHS established: "fee-for-service SHS" model and "market SHS" model. Under the "fee-for-service SHS" user model, SHS are provided by a local Energy Service Company in exchange for an installation fee and monthly consumption fees. This model is in operation in Lundazi, Zambia. Under the "market SHS" user model, the SHS is bought by the user on the market under commercial terms. The user has start-up expenses with the initial purchase of the system and with technical support, such as installation, maintenance, repairs and renewal of batteries. The user does not have to pay a monthly fee for the produced electricity. Such a model is in operation in Kenya, which is also considered to be the most developed SHS market in Africa. Why is the "fee-for-service SHS" the most appropriate model for Zambia and why the "market SHS" model is more effective in Kenya?

The answer lies in the different institutional development in these two States. The data of the World economy rankings show that in the category of enforcing contracts, Zambia is ranked 86th and Kenya 107th out of 178 world economies. However, in the category of getting credits Kenya is ranked 13th and Zambia 97th. This data supports the findings that in Zambia the legal institutions and judiciary are more developed than the financial institutions. This means that contract enforcement mechanisms are strong and thus contracts between users and the Energy Service Companies are well respected resulting in regularly paid fees for electricity. Hence, the "fee-for-service SHS" model is very effective in providing wireless electricity in Zambia. Due to inaccessibility to credit for the rural population in Zambia, an unsubsidized over-the-counter market in SHS would not function, no matter how great the emission reductions from such a system would be. The situation is contrary in Kenya, where the financial institutions, especially the access to loans, are well developed. The rural population has access to loans for the purchase of SHS. This enables the unsubsidized market in SHS to flourish. While the respect for rule of law is lower in Kenya and corruption a big problem, the "fee-for-service SHS" model that requires respect for contracts and agreements would not function.

Nevertheless, the fact that the research on SHS concentrates on rural Africa, the abovementioned findings can be applied also to other areas of the World and to other technology transfer projects. Namely, the importance of this research lies in its illustration that the success of a technology transfer project is not dependent only on emission reductions, but also on the accessibility of the project to the targeted user. This latter requirement however, depends on the how well the project takes into account which institutions are developed in a State and how well they function.

67 Perspectives on Climate Action

Summing up from across conference themes of Governance & Climate Mitigation and Carbon Finance, Public Policies & Responsible Investment: How do we move forward? How do Business and Society combine in providing solutions? What are the perspectives for real, joint actions on climate change.

11.1 Understand social embeddedness as possible missing link for succesful BoP product innovation?

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Paper abstract:

The lives of the poorest on our planet, are devastated by deprivation due to the lack of access to good health, water, infrastructure and other normally public organized services. In Europe new technologies exist that could meet these needs . However, in all cases the current design only becomes accessible and affordable to the poor through economies of scale and/or product adjustments to enable local production using local resources and local distribution channels. The private sector has the potential to create such innovations through product and process (re)design. This capacity is one of Prahalad's (2004) arguments to promote private sector involvement in developing new business opportunities through effective linkages with the Base of the Pyramid (BoP) market. However, successful access to this market requires new insights in international business theory. Especially during the phases of market identification and product design, 'social embeddedness' is essential to define more effectively the opportunities for product and process innovations to access this new BoP market (London and Hart, 2004). This requires cooperation and building coalitions with "fringe stakeholders (Hart, S & S. Sharma (2004).

The international management literature on firm embeddedness in local contexts tries to derive management prescriptions based on organisations' need to adapt to local circumstances in order to survive (Lawrence & Lorsch, 1967), as sources of information, knowledge, physical resources, but also of power and legitimacy (Gnyawali & Madhavan, 2001). The local context is seen as a source of important information that headquarters are unable to obtain and that local embeddedness can deliver strategic advantages (Bartlett & Ghoshal, 1986; Birkinshaw, 1997). Despite the prescriptions for local responsiveness and the seemingly high value of firm embeddedness into local networks, the international business literature is ripe with examples of under-adaptation of firms to their local environment, be it in marketing (Dow, 2006), human resource management (Johnson, Lenartowicz, & Apud, 2006), or internationalisation strategy (Magnusson, Baack, Sdravkovic, Staub, & Amine, 2008). Local adaptation is normatively seen as a specific success factor (Hamann, 2004; Reichardt, 2006) but hardly reached in practice. This paper seeks to conceptualise social embeddedness in the light of IB theories, and to understand its effects on IB when aiming on the successful introduction of product innovations to BoP markets.

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11.2 Innovating sustainable solutions for developing countries: can BOP strategies be the mean?

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As highlighted by numerous reports from the Intergovernmental Panel on Climate Change (IPCC) developing countries are highly vulnerable to climate change, and mitigation remains challenging as gaps exist in understanding the vulnerability and the opportunities for adaptation and mitigation. An overarching challenge is the need for improved capacity to conduct integrated, multi-disciplinary investigations and develop sustainable solutions. During the past years, a number of facilities have been established to reduce and cope with the effects of global warming such as the Clean Development Mechanism, technology transfer, funding through Global Environment Facility etc. The main driver for targeting the challenges has so been driven by "traditional" public policy and development economics initiatives, but more recently a number of voices have argued for the inclusion of private sector to tackle the challenges. Not only as a partner, but as a driver as private sector holds capital, infrastructure and knowledge etc. that potentially could meet the vast demands at hand.

This trend steams from the pioneering work of C.K. Prahalad that basically argue that the 4 billion people living at the base of the pyramid (BOP) for less than 2 $ a day constitutes a huge market for private companies if they are able to provide products and service to meet the demands as for instance clean water, cheap energy etc. A market that constitutes an apparent untapped purchasing power of estimated 5.6 trillion $ from which:

Private companies can make significant profits by addressing the needs at hand.

Private sector can contribute to poverty alleviation, by meeting the evident demands for clean water, sustainable energy etc.

Multinational companies should play a leading role in this process of selling to the poor.

In the literature (Hart & Christensen 2002; Prahalad 2006; Kandachar & Halme 2008), as well as in practical examples, two distinct lines of thought are found when targeting BOP markets in developing countries. An example of technology driven innovation to meet the BOP demands for clean drinking water is Life Straw – a high tech "straw" consisting of 12 chemical filters to purify water (www.vestergaard-frandsen.com/lifestraw.htm). Another approach is based on existing competences in companies, when for instance soap producers penetrate the market through product adaptation - as for instance by selling soap in smaller boxes.

A number of projects have been launched within the last years to meet the demands in the BOP markets, and thereby tested collaborations with non traditional partners to understand the cultural values in the potential market, re-calibrated cost structures, re-organised distribution channels, marketing etc. The cases show that business targeting BOP markets *can* contribute to poverty alleviation and to mitigation of climate changes (GrameenPhone, Lightuptheworld, *www.cemex.com*, microfinancing).

However, rather little is known about the dynamics of the BOP business models that often is based on close collaborations and alliances between private sector, NGO's and universities. The majority of the

BOP cases have focused on activities of multinational companies in developing countries, but fare less is known about business strategies and models targeting BOP markets, when deriving from small and medium-sized enterprises (SME) that constitute 95% of the private sector.

Adding to this the current knowledge is relatively weak in the understanding of BOP business models, which take the departure in sustainability practises. The BOP paradigm is often applied based on an interest in new markets and to increase availability of products and services to new potential consumers. From a ***sustainability*** perspective this is not durable, as the current consumption patterns have influence on global warming.

Further in the effort of developing sustainable business models a core challenge is the active participation and co-development of end users in the products and services innovation. Initiatives such as the BOP-protocol (http://www.bop-protocol.org/) underlines the inclusion of end-users, but concerns arises around this ***participatory approach***, as the initiative, agenda and not the least resources is steaming from the private sector. The concern is therefore if new upcoming solutions are addressing the basic needs as outlined in the Millennium Development Goals (http://www.un.org/millenniumgoals/) or if the BOP approach is merely a new approach to penetrate untouched markets.

Based on these initial concerns, the aim of this paper is to undertake a discussion of the current **BOP paradigm** to support the development of a sustainable, participatory multi-stakeholder business model frame work, which moves from:

Focus on multi-nationals companies towards inclusion of SME's

Market penetration towards sustainable development

Private sector /CSR initiative towards a participatory, bottom-up initiative

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11.3 Innovating sustainable energy for the rural BOP: The case of mini-hydro power in rural Ethiopia

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In recent years, the corporate and academic interest in entrepreneurial solutions to poverty alleviation has increased significantly. The Base of the Pyramid (BOP) proposition suggests that business involvement can be mutually beneficial for companies and the very poor. The idea of including the very poor in the global economy, both as producers and consumers, has been presented as a fresh approach to poverty reduction. It is self-evident that increased production and consumption activities in these population segments are intrinsically linked to the global environmental challenges. Nevertheless, there are few studies addressing this issue: products, services and business models that combat poverty without causing extensive stress on the natural environment. There is an urgent need to gain knowledge on how to create intelligent solutions that are economically, environmentally and socially sustainable.

Energy poverty is prevalent at the base of the economic pyramid. Nearly two thirds of the population of the world live without electricity, most of them in the rural communities. Although not as dramatic as lack of nutrition or shelter, the lack of electricity indirectly influences the lives of poor in a number of ways. It often means lack of light or high costs of other sources of light, such as kerosene for lamps. Often it means that cooking energy comes from wood, causing indoor air pollution and respiratory diseases. It also means that basic activities such as grinding of grain or pumping water in rural communities have to be conducted manually. These are laborious tasks for women and young girls. Much of their time goes to fetching water, preparing food without help of even simplest appliances that would require electricity. It also means that people have to spend a considerable amount of their income to sources of power (e.g. wood, kerosene, batteries for radio) that the wealthier ones get cheaper since they can fulfill their needs with the help of electricity.

This paper presents a case study of a corporate initiative where a new CO_2 emission free energy technology - mini-hydro power – is implemented in one of the poorest countries in the world, Ethiopia. Over 80% of the population live in the countryside and only around 2% of the population have access to electricity. The recent history of Ethiopia is similar to that of many other developing countries: Despite an abundance of natural resources, failing governance has led the country into deep poverty and dependence on foreign food and development aid. Somewhat contradictory to the common imagery of drought and famine in Ethiopia, this high altitude country is in fact the source of 84% of the Niles water. However, less than 10% of the renewable natural resource of "falling water" is electrified. This would not be as tragic a fact if not coupled with the fact that most households use wood as cooking fuel, which has lead to deforestation and erosion. From the original 60 %, today only less than 2 % of the land area is covered by forest. Deforestation has left parts of the Ethiopian population without arable land, and led to mass migration of others from unlivable areas to those which can support. But the pressure on the land is constantly increasing and fuel-switch alternatives to wood are desperately called for.

The mini-hydro power plant technology allows for decentralised electrification, that utilises this natural resource in a way that is respectful of the surrounding environment. This is an entirely new approach compared to the traditional large scale centralised power plants. The primary aim of the mini-hydro power plant project is to electrify rural villages in Ethiopia. However, in order to ensure a steady demand and thus a market-driven business model, the project strives to support local small-scale entrepreneurship and to create a non aid-reliant, dynamic socio-economic ecosystem surrounding the new source of electricity. This is a challenging ambition which requires innovative multi-stakeholder solutions. The technological innovation is not enough per se since a successful implementation requires additional business model innovations.

As in many other developing countries, an additional challenge is the institutional situation. For years, the Ethiopian government has promised to electrify the Ethiopian countryside but has not lived up to its promises. Despite this, companies that invest in rural electrification have to work closely with the government due to regulations and their projects risk being taken over by the national energy company. Since the villagers, local small businesses and cooperatives have been repetedly dissappointed by the government, close cooperation with the national energy ageny undermines the credibility of the new electricity provider. Thus the company managers have to walk a fine line between the need for cooperation with the goverrnment yet avoiding to be associated with them.

The vision of the company is to scale up operations throughout Ethiopia, and to introduce the concept in the many other developing countries where "falling water" is still under utilised. If successful, this is can be an example of one type of innovative, multidimensionally sustainable solutions addressing climate change alongside with poverty.

At the June conference in Alborg, we will share field insights as well as video and photo material from our most recent visit to Ethiopia in February- March 2009. We also hope to spur the theoretical discussion on ways of creating environmentally sustainable BOP solutions in difficult institutional settings.

11.4 The Business of Water. The potential and limitations of Base of the Pyramid strategies for delivering a sustainable water supply in developing countries

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Background

According to UNDP, currently 1,1 billion people in the developing countries have inadequate access to safe water for household, agriculture, and production activities. Furthermore, climate changes are causing a worsening of this global water crisis due to changes in rainfall patterns and higher temperatures. Amongst the effects are severe productivity losses in agricultural production especially for small farmers, exposing an additional 75-125 million people to the threat of hunger (UNDP 2006: 28).

UNDP calls for increased attention to this challenge with an ambitious increase in aid for water management programs. However, the question remains:

- Is a donor-based approach capable of addressing this challenge in time?
- What role can and should the private sector play in creating sustainable solutions to this challenge?

The ambition of this paper is to explore the potential and limitations of the private sector in developing solutions to the challenge of ensuring socially, environmentally, and financially sustainable water supply across the globe. I will take as a departure the approach of the Base of the Pyramid strategy and the assumption it holds of business being able to make profit and alleviate socio-economic problems at the same time. Hereafter, I present three cases of market based water solutions, and based on these examples, I will discuss the potential and limitations of a private-sector approach in relation to a more traditional development approach, and in conclusion suggest perspectives for further research and practice.

Introducing the concept of Base of the Pyramid

The term Base of the Pyramid (BoP) refers to the 4 billion people constituting the base of the economic pyramid in the world. According to Cornell University's BoP Learning Lab Network, a BoP enterprise has the following characteristics:

¥Based on a private-sector business model with mutual value creation for both community and the enterprise

¥Triple Bottom Line strategy with consideration of both environmental, social, and economic impacts

¥Aspiration and potential for scale and replication

However, in practice, there is not one overall BoP Strategy, but a range of different strategies and business models. The existing cases in the BoP literature show different business models, and different priorities between social impact and profit as either means or goal.

A main part of the discourse in the field of BoP is coined in terms of business concepts, presenting BoP as an 'untapped market' (World Economic Forum 2009). There is thus a tendency to project a western-centric business logic and practice into a socio-economic context in low-income communities that is in many ways very different from the markets in the usual business setting. One key difference is what Erik Simanis and Stuart Hart are highlighting in their distinction between *market entry* and *market creation*. There might be a need for access to water, but not necessarily a market (Simanis & Hart 2008: 64). This clearly points to one of the challenges of a market based approach to water supply, which I will explore further in the three examples.

A business of water?

The report from the World Resources Institute on the market potential in different sectors of the 'next 4 billion customers' estimates the BoP market size for water to be 20,1 billion usd (World Resources Institute 2007: 53). The question is, whether and how this potential can actually be realized. I will present three examples of private-sector based approaches to water supply, looking at aspects of technology, socio-cultural competencies, partnerships, and business model.

The first example presents Kalebu Ltd., an SME water supplier in Uganda, who is organized in the Association of Private Water Operators in Uganda. This case is a more 'traditional' example of private companies delivering a service of piped water and water kiosks on behalf of the public sector.

The second example is from the multinational company Proctor & Gamble, and the project of PUR – Purifier of Water, which focused on providing sachets of powder to purify water at point-of-use in households. The project failed to become a viable business, however, and is now part of the company's non-profit activities, being sold at production cost to humanitarian organisations.

The third example, which has proven a market-based business model and is working directly with communities, is the Water Health International. The technology of this company is based on a high-tech solution for cleaning water using ultra-violet light, and the business model incorporates elements such as community-based loans.

These examples show different technologies and business models, and they might also broaden or challenge the definition of a BoP Strategy. They also point to the opportunities and barriers of private companies in providing safe water. Providing sustainable solutions to safe water involves much more than a technological solution. It involves people in their everyday life, and the success of the solution is very dependant on the ability of building on the local socio-cultural context and resources.

Business and development – a new potential?

Although the private sector is new to the business of water, water has been a focus of development programs for more than 50 years. However, with modest success. Key challenges of traditional development approaches have been bureaucratic entanglements, corruption, lack of maintenance systems, lack of financial sustainability, top-down approach, and lack of engagement of the local community (Gardner & Lewis 1996: 62ff).

The BoP Strategy can be used as a probe into what the limitations of development and business are, and how we can develop interesting models that combine the interests of both. Is there a pragmatic and socially sound commercial solution in the donor-space of international development? And what competencies and mindset are needed from business to engage in this work?

I will bring these aspects into my final discussion of the potential and limitations of a Base of the Pyramid strategy in providing socially, environmentally, and financially sustainable solutions to water access in developing countries.

12.1 Greens rush in: CleanTech venture capital investments - prospects or hype?

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When Aldrich and Fiol published their influential paper on industry creation, 'Fools rush in? The institutional context of industry creation' (1994) the primary focus was on the hindrances to industry evolution stemming from lack of legitimacy, which may prevent key stakeholders from understanding the nature and potentials of the new types of ventures. This adds to 'normal' constraints for industry evolution such as uncertainty related to new markets, capital constraints, untrained employees etc. Precisely the legitimacy may in this case, clean tech investments, be in place at a macro level of aggregation; it is widely recognized that such investments are needed and render societal value. It may be questioned, though, if the same holds on a micro level. Do investors and fund-of-funds institutions regard clean tech investments as hype and beyond the scope of a purely for profit investment strategy?

There is growing interest in the clean-tech market. Despite this interest there is sparse knowledge on the growth patterns and prospects for this sector. This paper is focused upon the investment processes and –levels in the sector and focuses upon, but is not confined to, venture capital investments. One justification for this focus is the role venture capital has had in stimulating and disseminating technologies in emergent sectors.

The pace of investment in clean-tech companies has in the past decade accelerated.
The question is if the present trend in investments into the clean-tech industry is just another 'hype'; a(nother) case of herding behaviour of venture capitalists? In a broader perspective an additional two more general research questions are underlining the research – what are the investment criteria of venture capitalists and secondly, how does venture capital expand into new industries. Whereas a number of even early papers addressed the investment criteria of venture capital firms the dynamics in how venture capital transfer into or emerge in new industries is scarcely researched.

Denmark has had a long tradition for investments into environmentally friendly technologies, but has until now not succeeded to the same extent as in several other countries to attract notable private capital to the clean-tech industry. The paper is mapping the investments and assesses prospects for the future development of the industry in Denmark. The paper also speculates why Denmark on the one hand has well-developed technological and industrial strongholds in cleantech and well-developed markets for innovation finance (3rd in Europe after the UK and Sweden) but on the other hand have relatively little venture capital available for cleantech investments.

The paper identifies important dynamics of these investments, such as environmental problems and concerns, increases in prices of energy and regulation. An enabling factor for industry development is the fact that the technologies involved are usually not particularly sophisticated and expensive; rather there is a large element of technology spillovers and adaptation from other industries. As a result of these drivers of the industry many cleantech segments are fast growing and large markets, something particular attractive to venture capital firms who typically are looking for scale-able, high growth opportunities. However, recent trends at the venture capital market show a focus on still larger companies and on second round financing of existing portfolio companies rather than new investments. This indicates that the industry as a whole has become more risk averse. Indeed the traditional perception of venture capital as being particular risk takers has been questioned.

Just as doubts has been raised with respect to how rational, stage organized and planned venture capitalists decision making processes really are it may be questioned if decisions to invest in the cleantech industry are based on solid due diligence and forecasts or just expectations of further investor interest and rising share prices of this particular type of firms. Some characteristics of cleantech investments may scare venture capital away. In some segments, especially within energy, both the long time horizon involved and the amount of capital needed for development is often substantial and above what venture funds will be prepared or able to pay. Because many cleantech technologies are applications of existing technologies to new areas it is often difficult to achieve IPR protection. This may also be of concern for venture capital firms.

Venture capital has the image of being exceptionally prone to take risks and exploit new opportunities. Venture capital is regarded as a critical factor in the commercialisation of new research into viable businesses. According to this perception there should not be any strong path dependencies in how venture capital is allocated on industries. In practise considerable conservatism persist. Of course there is a number of fund managers who take in new types of investment areas and maybe even have visions of expanding whole new industries. However, the mix between these conservative venture capitalists and their more visionary colleagues is probably difficult to influence and dependent upon a number of factors. Moreover, there is likely to be an element of herding behaviour in venture capital. A few prominent players within the industry are setting the path to follow and the rest is following.

It is found that the fact that Denmark has seen a large public funding of the technological development related to the now industrial strongholds within cleantech may contribute to explaining why venture capital investments have been sparse. Also the strong industrial base of start-ups within the industry may have limited the demand for external competencies of technologies, market and industry from investors; these were already present in the firms. Even if a demand was there investors would probably not be able to meet this demand as there is currently only limited investor competencies in this industry. Moreover, investors also have only limited industry specific networks. In cleantech networks may be particular important because b2b sales rather than b2c is the rule, and this requires networks for penetrating new markets.

12.2 Are Cleantech Companies Special?

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Several economies are experiencing an increasing interest among business developers to stimulate business solutions to solve environmental problems. On the regional level this is seen as a way to create jobs, bring economic growth and solve environmental problems, simultaneously. In e.g. Sweden there are numerous initiatives on national and local level to stimulate innovation and business development in the environmental technology sector; often called "Cleantech". Initiatives to support business development are nothing new and have been done for decades in many different lines of business. One important question to ask is if there is a difference in supporting cleantech companies or if the same ways of working can be used as in general business development.

Reasons for designing specific support to cleantech companies might be found in differences in company structure (size, age, ownership etc.), market for environmental products (dependency of legislation and authority decisions, export rather than home market etc.) or offerings (product is part of a system; customer value is not clear etc.). But it can also be argued that there is nothing special with cleantech companies and such companies therefore can be supported in the same way as other companies.

In this article I discuss different approaches used in Sweden to support cleantech companies. In Hjelm et al (2008) I made a first survey of four Swedish regional initiatives in this area. One important conclusion was that benefits for participating companies were set first, i.e. to create jobs and increase sales. Environment came second. It was also difficult to measure success and this was often limited to ask the companies if they were satisfied or not. This article is a follow up of that study and I present some more initiatives identified and gives examples of the diversity of such initiatives. I also discuss if cleantech companies are special and if so, what are the implications for business support organizations wanting to stimulate the development of cleantech companies.

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12.3 Business Models for Sustainability—Innovative Regional Business Models as Subject and Trigger of a Sustainable Change in the Energy Industry

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Are the characteristics of "conventional" business models in the energy industry linked to defined problems which occur when performing business? And to ask for the opposite correlation, are "alternative" models able to promote positive effects—positive in terms of an ecologically and socially sustainable energy industry? If the current conventional structures tend to harm man and the environment, what is the role of the underlying business models, i.e. the business logic of earning money, when asked for a possible shift towards sustainability in energy production and supply?

To a certain degree it has to be recognized that the dominating oligopoly of a few multinational energy companies is based on and highly addicted to using fossil fuels. They operate in centralised structures which are obviously opposed by alternative approaches of decentralised energy systems based on regionally available renewable resources like biomass, wind and solar energy. According to some authors this situation should rather be understood as the convergence than the polarity of different production and supply systems. Independent from questions of convergence or opposition it is obvious that different ways of production and supply are based on different business models and logics. Is the corporate sustainability performance related or even dependent on the different business models' characteristics?

The approach at issue seeks to find out how innovative enterprises and their business logics may contribute to solve central sustainability problems. This research—in a first step branch specific—shall answer the general question of how essential sustainability problems could be addressed by new and uncommon ways of production and supply. The objects of investigation are observable and hypothetical business models following general business model frameworks. So far, existing business model research related to issues of corporate sustainability often deals with cases of car-sharing, i.e. a more service oriented perspective.

The expected insights from this specific perspective have to be generalized as research on the business model / corporate sustainability correlation is currently not too far. To analyse this correlation the approach has to focus on a suitable unit of analysis, which allows considering implications of the embedding socio-technical system but is also detailed enough for gathering information on organisations' structures and management approaches. It is assumed that on the business model level organisational and managerial aspects, their expression via business performance and the connectedness to general and specific environments could be sufficiently analysed. This means, issues of performing business and its effects will be examined crossing companies' borders following defined aspects like *infrastructure management, product innovation, customer relations and financial aspects*. In other words: the resource-based and the market-based view of the firm have to be combined for an integrated point of view. If the applied business model definitions make it necessary to look at the whole supply chain—maybe from resource extraction to the customer's energy use—the analysis has to take care in order to understand the characteristics and the relevance of the business models and their factors of success (or failure).

It follows that in this context the term business model has a twofold meaning: Firstly, it is *a theoretical perspective of analysis.* Secondly, when it comes to distinct considerations of the relations between bioenergy businesses and questions of corporate sustainability, it will be *an empirical result of examining specific case studies.* Three steps have to be taken to apply the described perspective and to develop an appropriate understanding of business models and their contributions to corporate sustainability:

1. Find out which theoretical elements of business models are considered to be most important,

which business model frameworks are most developed.

2. Test if the resulting definition and framework are applicable to innovative concepts like bioenergy villages, closed regional supply chains and others to be identified.

3. Examine if the business model perspective helps to address general questions of corporate sustainability, i.e. if a "business model for sustainability" results.

The current work aims at connecting business model frameworks and questions of corporate sustainability and its application to first case studies (steps one and two). The latter refers to examples like the bioenergy villages Jühnde (Germany) or Mureck (Austria).

12.4 Potentials of Using Solvent-free Industrial Cleaning in Swedish Manufacturing Industry

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The manufacturing industry today uses different kinds of chemicals in its cleaning processes. The industrial cleaners often contain some sort of degreasing chemical to clean parts and components before for instance surface treatment processes. These types of cleaning methods imply expensive and dangerous handling of chemicals in the manufacturing process, as well as in the transportation of hazardous waste. Furthermore, the cleaning processes also uses a substanstial amount of energy for cleaning.

"Ultra-clean water" is relatively new way of cleaning without the use of chemicals. The method has proven successful, for example, in the cleaning of building exteriors, transformer stations, and tunnels. The procedure has been to spray with low-pressure, thus better salvaging the paint yet removing dirt, oil and debris from surfaces such as walls. Successful projects, for example, include the cleaning of the above mentioned building exteriors and tunnel walls at and Södra Länken tunnel system in. The aim of this paper is to explore the potentials of how "ultra-clean" water cleaning can be used in the manufacturing industry. The overall goals of the project are to reduce manufacturers' use of chemicals, and also the amount of emissions to landfills. Another goal with the project is to reduce the environmental effects on the manufacturing site, the amount of chemical emissions during manufacturing and the amount of chemical transports from the facility. Furthermore this innovation have a potential to improve the working environment within the industry and at the same time reduce the energy consumption used for cleaning. Two case studies will be presented in which environmental performance of a prototype of the solvent-free cleaning technology is compared with existing technologies. The first case is dealing with cleaning of circuit-boards with special attention to flux material residues. Furthermore the second case focuses on surface treatment industry and focuses more on the ability to clean oily and/or fatty surfaces.

To summarize, this research project have a large economic and environmental potential in its unique constellation of university research and manufacturing company involvement. At this moment the potentials are preliminary but shows a lot of promise for the future.

24.1 The Research on Microfinance Modes for BOP Market in Rural Areas of China

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The Research on Microfinance Modes for BOP Market in Rural Areas of China

This article studies the financial innovation modes for the market of low-income group (BOP, Bottom of the Pyramid) in rural areas of China and aims to find out a new financial innovation path that could reflect the viewpoint of sustainable development and also link the financial institutions' economic goals with their social responsibilities. Microfinance business for BOP clients can not only bring economic profit to financial institutions, but also solve the poverty problem of BOP by increasing the purchasing power, smoothing the consumption, and supporting the entrepreneurial activities of BOP to improve their real income. This article explores the innovation modes and general principles of microfinance business for BOP market in rural areas of China from the perspective of BOP theory, and compares the similarities and differences between microfinance business in rural areas of China and Grameen bank to find out how supporting policy system, culture and institutional environment influence the microfinance activities, and analyses the mode selection strategy for financial institutions to develop the BOP market in rural areas of China.

Based on case study, this article finds out four main types of microfinance modes for BOP market in rural China according to the current rural microfinance practices. The four types of microfinance modes are the mode of microcredit for rural residents, the mode of co-guarantee loans for rural residents, the mode of innovative mortgage loans and the mode of third-party involvement loans.

Through in-depth investigation, this article analyses the characteristics, process and mechanism of each microfinance mode. The mode of microcredit for rural residents is generally based on the credibility of rural residents, and the financial institutions provide the loans to rural residents in the approved amount limit and duration without mortgage or security. Financial institutions prefer this mode to others because it is easy for financial institutions to operate and the term of the loans, principal and interest repayment is flexible so that it suits to the economic condition of rural residents. However, financial institutions usually consider the poor people as bad credit people based on the following assumption that poor people can not pay the loan because they usually can not earn enough money in the future. As a result, it is difficult for rural residents to get approved for their loans and even if they get the loans, the credit amount is quite low. The mode of co-guarantee loans for rural residents is that rural residents apply for loans from the rural financial institutions through the establishment of mutual guarantee group, and access to credit under joint and several liabilities amongst team members. In this mode, financial institutions are at lower risk than they are in first mode. And at the same time, it can solve the difficult problem that rural low-income group can not access to credit to some extent. The mode of innovative mortgage loans is that financial institutions allow the rural low-income group to provide their economic resources as qualified and effective mortgage, such as forest tenure, coastal land tenure and pigs in vivo. In this mode, the restrictive conditions are higher because the rural residents need to have the property which can become mortgage by innovation. The mode of third-party involvement loans is that the third-party entity involves in the loans from financial institutions to rural residents, which usually has benefits relationship with the rural residents, playing a role in security for rural residents. It is universally regarded as a financial innovation in rural areas, because it helps the rural residents to get loans without mortgage. The third-party company is the most common entity in this mode, particularly the agricultural company exploiting the resources from BOP. The affordability of this mode is relatively high, especially if the company can purchase the agricultural production or output from rural residents at a pre-agreed price, so that rural residents can have certain income in the future. Besides, the company can obtain the custom agricultural production at a reasonable price and financial institutions can make profits with low risk. Therefore, all the stakeholders will benefit in this mode°ª°ª Rural residents can improve their living condition and eliminate poverty; Financial institutions and companies can link their economic goals with their social responsibilities.

In the comparison of the strengths and weaknesses of these four modes in the environment of financial innovation in rural China, this article explores the microfinance mode strategy for the financial institutions to enter the microfinance market for rural low-income group in China.

This article presents three principles of microfinance innovation for BOP market in rural China: (1) Ensuring the affordability of microfinance service. (2) Developing the applicability of microfinance service. (3) Making the best use of the social capital of the financial institutions. Furthermore, by comparison with the activities of Grameen Bank in Bangladesh, this article figures out whether there are principles in common and whether the institutional environment, culture and the political and regulatory support lead to the differences of the microfinance activities.

24.2 Climate investments as a tool for community development

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Densely populated areas in the third world, like Lusaka in Zambia, has experienced immense urban migration that is manifest in the unplanned settlements known as peri-urban areas or compounds. In addition to the questionable human living conditions, the life styles under such circumstances tend to result in ineffective and inefficient use of energy and resources, and serious environmental impacts. The use of charcoal and the collection wood tend to result in deforestation and the ineffective ways or burning the fuel results in considerable air pollution and a very high global warming effect, in relation to the quantity of energy that is being made useful, e.g. for cooking.

One of the most challenging issues currently being faced is the availability of basic social services like access to safe drinking water, sanitation facilities and solid waste collection. The water supply, sanitation and solid waste management infrastructure is currently unable to sustain the increasing population in many parts of the evolving megacities. The national and local governments usually do not have the means to supply the necessary services. In many cases the influx of inhabitants is greater than the development of the services, leading to a lack of basic services. In many overcrowded settlements there is an acute shortage of clean water and reliable energy supply and a long-term risk for escalating environmental degradation, including litter, pollution, contamination and human health problems.

The climate change and even more the total global development require that we change our way of living into a more renewal oriented and sustainable way of living and thinking. Change must come in many forms, in society, at a personal level and also changes in technology. This paper explores how the introduction of new technology can be used as an effective tool to augment infrastructural and societal development processes in local communities. The global warming is a symptom of ineffectiveness and inefficiency. It is caused by mismanagement of resources and energy flows. The mismanagement is most obvious in poorly developed settlements.

Improvements of motivation and improvements in a wider systems perspective can be included in the cost benefit assessments of technical investments, as a mean to promote a more effectual development process. Collaboration with carbon trade and socially responsible organizations can help to provide an extra thrust for socially and environmentally favourable investments.

The material presented describes an action research case study as a part of an UNICEF development project in Lusaka, Zambia and also relates to experiences from small-scale bio-energy developments, on the Swedish countryside.

Community development and empowerment of the local people is recognised as an important development mechanism to improve the situations in poor urban areas. To lift the inhabitants from being "victims" of the circumstances they need to be involved in the community as a way to raise the standard of living, since the government cannot help the whole population. The way to empower the people is to give them control of the neighbourhood as a mean to motivate them to care and to take responsibility for the community.

The Lusaka project includes development of a competence centre aiming to build local knowledge and motivation. The paper analyses how the dialogue about the new bioenergy technology can be used as a way to create changes in the local everyday life. The new technology gives opportunity and knowledge on alternative ways of how to handle solid waste at an individual level. It also enables improvements of water quality, health status and employment in the local community. It is also a considerable environmental improvement when the waste-based bio-energy replaces the widely used burning of charcoal for cooking. The smoke from charcoal is not only harmful to health, but also has a global warming effect. By not using charcoal as fuel many hectares of productive forests can be saved which improves the local environment and decreases the global warming. A fairly small investment in bio-energy production can facilitate a deeply needed municipality development process.

25.1 Joint Action on Climate Change Is Africa Part of the Problem or the Solution

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Climate change and the associated global warming are a major challenge in the world today: extreme weather events such as flood and droughts; food insecurity and famine; disease etc. Climate change threatens mostly the weakest economies and disadvantaged poorest people. GHG emission is considered to be responsible for this (IPCC 2007). The energy contributes about ¾ of the CO_2 emissions, 1/5 of the CH_4 emissions and a large quantity of N_2O. It also produces NO_x and CO, which are not themselves GHG, but influence chemical cycles in the atmosphere that produce or destroy GHGs (IPCC 2007).

Although Africa is predicted to be more vulnerable to climate change than any other continent (Glantz 2005), it is the least producer of GHGs (Table 1).

Table 1: Per capita GHG emissions in 2000 (Houghton 2003)

	tCO_2e with land-use change	tCO_2e without land-use change
Asia	4.5	3.4
Europe	10.6	10.5
Middle East & North Africa	5.7	5.6
Sub-Saharan Africa	4.5	2.3
North America	23.1	24.1
Central America & Caribbean	6.3	4.5
South America	11.1	5.3
Oceania	24.2	19.1

In order to mitigate the impact of climate change, the UNFCCC and the Kyoto Protocol were crafted. The Kyoto Protocol legally binds Annex 1 countries to reduce their collective emissions of GHGs by 5.2% compared to the year 1990 (UNFCCC 1998). It provides a CDM as one of the vehicles for mitigating GHG emissions, whereby Annex 1 countries may earn certified emission (CER) credits through investment in non-Annex 1 countries. Other initiatives that are similar to CDM are the World Bank's Prototype Carbon Fund, Community Development Carbon Fund and the Bio-Carbon Fund.

Performance of Africa in the CDM

CDM has two purposes: (i) to assist Annex 1 countries to meet their GHG reduction commitments, and (ii) to contribute to sustainable development of the recipient non-Annex 1 country. So far Africa has 87projects with 98,577 kCER potential by 2012 compared to the rest of the developing world which have

4,185 projects with 568,254 kCER potential i.e. more than 96% of all CDM projects. The key question is why Africa is not featuring well? Will the CDM model work for Africa in the Post-Kyoto era? Or do we need a different model for Africa?

Performance of Africa in the Prototype Carbon Fund

The PCF was established in 1999 as a public-private partnership aimed at catalysing the market for project-based GHG emission reductions (ERs) within the framework of the Kyoto Protocol, while contributing to sustainable development (World Bank, 1999). Table 4 shows geographical distribution of carbon fund projects.

Table 4: geographical distribution of CF projects (World Bank 2007)

	PCF (%)	CDCF (%)	BioCF (%)
Africa	3	38	34
Europe and Central Asia	14	7	14
Latin America and Caribbean	15	14	39
South Asia	-	35	4
East Asia and Pacific	68	6	9

Again it can be seen that Africa is not doing well under the PCF. The same questions may be asked. Among the constraints mentioned by the World Bank Report on CF is "Low capacity of poor developing countries to identify and develop projects. Priority countries, in Africa in particular, suffer from weak business environments, and high project-related currency and country risks." This fact will remain true post Kyoto.

Performance of Africa in the Community Development Carbon Fund

CDCF was created in 2002 to extend the benefits of CF to the poorest countries and to poor communities in all developing countries, which would otherwise find it difficult to attract carbon finance because of country and financial risk (World Bank, 2002). The main aim was to assist developing countries reduce their CO_2 emissions and earn carbon credits. It combines community development attributes with emission reductions to create development plus carbon credits; and aims to improve the lives of the poor, and their local environment, significantly. CDCF supports a wide range of projects, such as crop residue to energy conversion, cooking stoves, biogas, mini hydropower, waste management, wastewater treatment, fuel switching, efficient brick making etc. By 2007 (?), 85 projects had been identified and cleared for Carbon Finance Document (CFD) preparation, for a cumulative purchase of 33.6 million tCO_2e of ERs, representing a commitment of $300 million.
Africa features strongly under this fund (38%) (Table 4). This may be attributed to a number of reasons:

The combined objectives of carbon credits plus community development make this particularly attractive to African counties

Relaxation of the constraints of country and financial risk on disbursement

The question to as, should this be the model to follow for Post Kyoto activities?

Performance of Africa in the BioCarbon Fund

The BioCF was designed to provide carbon finance to demonstrate and test projects that sequester or remove GHG in forest, agricultural, and other ecosystems (World Bank 2002). The BioCF has been set up to buy carbon credits from forestry and agriculture projects. The goal of the BioCF is to remove CO_2 from

the atmosphere, and to improve livelihoods through the production of (non-timber) forest products. The BioCF Participants' Committee has approved 33 projects giving an estimated $41.5 million worth of emission reductions.

One risk involving the use of biological sinks to comply with Kyoto targets is whether the sequestered carbon will remain sequestered indefinitely. To cover this "non-permanence risk", it is intended that the BioCF will replace the temporary carbon credits (issued from land use and forestry projects) with permanent credits generated by non-sequestration projects that are under development by other carbon funds managed by the World Bank (World Bank, 2007).

Again under this fund Africa features prominently (Table 4). However, CO_2 sequestration projects may not bring about rapid economic development in the short term, particularly when compared with CDM projects which involve multimillion dollar capital investment.

Performance of Africa in other carbon funds

The performance of Africa in other funds is as follows: Netherlands CDMF (3%), Italian CF (12%), Danish Carbon Fund (15%) (World Bank, 2007)

Conclusion

Although Africa's contribution to GHG emissions is very small, Africa is the most vulnerable continent to climate change since widespread poverty severely limits the capabilities of communities to adapt to such changes. Because of its significant capacity as a sink, Africa needs to be part of the solution to climate change problems. However, interventions that lump together Africa with other developing countries seems not be working for Africa. This fact needs to be taken into consideration when the world is negotiating post-Kyoto climate change mitigation measures.

25.2 CDM: A Mechanism to Promote Solid Waste Management Efficiency and GHG Reduction in Thailand

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The main objective of this study is to evaluate total amounts of GHG emissions from landfills and potential carbon credits from electricity generation projects of Bangkok Metropolitan Areas (BMA). Total amounts of GHG released to the atmosphere from two landfills which receive wastes from BMA are estimated under different management scenarios. The results show that methane released from Phanomsarakam and Kampangsan Landfill during 2005-2024 are approximately 2.27 and 5.11 million tons carbon dioxide equivalent if nothing is implemented to collect and utilize landfill gases. If methane gases are collected and then flared, it can reduce amounts of GHG emissions by 65 percent. If methane gases are used for electricity generation, it can decrease amounts of carbon dioxide emission by 69 percent. Moreover, electricity generation using landfill gas will displace electricity generation by grids which mainly use coals and natural gases. This project could help reducing GHG approximately 2.4 million tons of carbon dioxide which therefore can be claimed for certified emission reductions under a CDM project. Additional incomes from the CDM project create a great incentive for investment and promote a better solid waste management and global warming mitigation for the future.

Introduction

As being part of globalization, Thailand has increased in rates of consumption and production which eventually result in significant amounts of wastes that the country needs to deal with. Moreover, increasing future population can intensify this solid waste crisis. Solid waste management in Thailand is mainly done by landfills because it is the least-cost approach comparing with incineration. Municipal solid wastes under anaerobic condition in landfill will generate methane which is a potent GHG (23 times CO_2e). Without methane collection and utilization, landfills become important sources of GHG.

Total numbers of landfills in Thailand which actively operate are ninety (90) while total incinerators are three (3). Despite large numbers of landfills, only a few of them properly operate and maintain (with methane gas collection) because no regulation mandates for methane collection. Consequently, there is very little incentive to collect methane from landfill to generate electricity and increase waste collection efficiency. A large amount of investment needed is one of major barriers. Currently, governmental capability in providing financial supports to start up this kind of project is very little and insufficient.

Trading of Certified Emission Reductions (CERs) from CDM projects can help Annex I countries to offset their GHG obligation in a cost-effective manner while providing financial supports to help developing countries to be part of global GHG reductions and adopt clean technology. Therefore, CDM is an excellent market-based mechanism which could help increasing efficiency of environmental management and GHG reduction. Currently in Thailand, thirteen (13) CDM projects have already registered by UNFCCC Executive Board. However, Thailand only has 1 approved CDM project from landfill gas to energy category. Despite, total waste handling and disposal type projects around the world are 321 projects (UNFCCC CDM projects statistics, February 2009). The causes hindering CDM projects implementation in Thailand have not been fully understood despite high potentials and benefits from this CDM type of project if implemented widely.

This challenge becomes a main focus of our research by using Bangkok as a case study. Bangkok as a capital of Thailand has a waste generation rate approximately 8,400 ton/day (BMA, 2008). However, only about 40% of these wastes are collected and then transferred to 2 active landfills, Panomsarakam and Kampangsan Landfill. Due to lack of sufficient financial and administrative capacity, BMA will soon face serious problems if solid wastes still remain inefficiently managed. Finding solutions to promote CDM projects will create a great incentive for investment to improve this situation.

Objectives

The main purposes of our investigation are:

1. To estimate total amount of GHG generation from solid wastes and evaluate potential carbon credits from BMA landfills to energy generation

2. To identify factors supporting and hindering the CDM implementation of landfill gas to energy type project and recommend solutions to promote efficient wastes management and GHG reduction in Thailand

Methodology

1. Data collection includes populations, quantity and characteristics of wastes generation, management system of Bangkok Metropolitan Administration

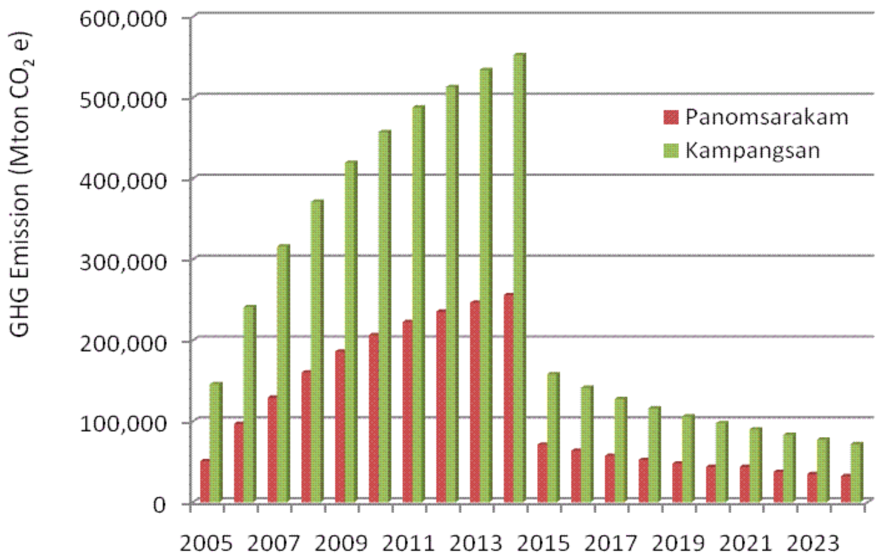
2. Calculation and forecast amount of future population, amount of wastes, amount of methane and emission reductions by following UNFCCC methodology (ACM001) : Tool to determine methane emission avoided from dumping solid waste disposal site (UNFCCC, 2008)

3. The implementation time for the project will be considered into 2 phases: short-term from 2005-2014 (10 years) and long-term from 2005-2024 (20 years). The CDM project will be considered for 10 years period with no renewal. The analyses are divided into 4 cases as summarized in the table:

Cases	Baseline	Scenario A	Scenario B	Scenario C
Short-term	No management	Flare	Electricity Generation	CDM Implementation
Long-term	No management	Flare	Electricity Generation	

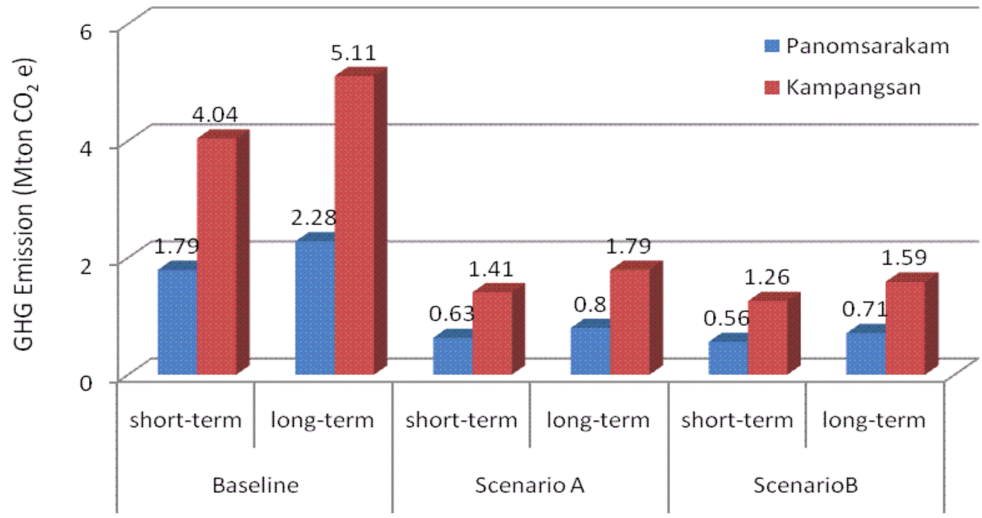
Results and Summary

1. Based on the current rate of waste generation and population growth, the amount of methane generation each year from 2005-2024 within the 2 landfills can be showed in the graph:



2. The analysis of GHG emissions from 2 currently active landfills in Bangkok can be summarized in

the figure:



3. Alternatively for scenario C, if the CDM project be implemented (for 10 year crediting period), the potential emission reductions will be approximately 2.40 Mtons CO_2e. These amounts of carbon credits can generate significant incomes and become an important financial incentive for the investors to decide to implement this type of project.

4. Several factors affect the implementation of CDM projects in Thailand including complexity of CDM application process and domestic license for electricity generation, cost of CDM implementation, high costs related consulting fee, long implementation time and turn-over rate for project approval, and uncertainty of investment return.

5. Uncertainty related to amount of electricity estimation depends on the efficiency of waste separation before putting into landfills, the design and efficiency of landfill gas collection system, the efficiency of electricity generator.

36.1 An Emerging Crisis Society and Sustainable Enterprises

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Text Not Available.

36.2 The role of TNCs in technology cooperation on climate change in the LDCs

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Technology cooperation is one of the building blocks of the climate change negotiations within the UNFCCC. At COP15 in Copenhagen an international agreement will hopefully be adopted, including international regulation for CO_2 emissions, actions to promote adaptation, and mechanisms to promote a scale up international technology cooperation, facilitating access to technologies relevant for both mitigation and adaptation.

Limitations in emissions will also have an effect on future and present possibilities for development and industrialisation. For developing countries this is a crucial issue as it may have great effect on their possibilities for social, industrial and economic growth. With new clean technologies developing countries could continue to develop without contributing further to CO_2 emissions. At the same time climate change also effects the developing countries tremendously and there is an urgent need for adaptation. Adaptation is much more than building walls for protection against flooding and there is a need for technology cooperation to increase access to the technologies needed.

Most technologies are owned, and developed, by corporations, dominantly transnational companies (TNCs) consequently the role of the private sector is very important to consider in the negotiations about a new climate change agreement. Many of the present initiatives are relating to the private sector. Especially the submissions of the EU rely heavily on private sector mobilisation.

However, technology cooperation is not given, and an agreement in Copenhagen will only constitute the frames for efficient transfer and development of necessary technologies. As has been underlined by Sanjaya Lall and other scholars the importance of TNCs to engage in reducing climate change and generally contribute to technology transfer is very important. TNCs control immense resources and can through their actions influence the development of capacity and capability of mitigation and adaption efforts in developing countries. In this regard both everyday activities and more carefully targeted CSR projects are of relevance.

In this report DanChurchAid aims to identify factors which are hindering as well as facilitating technology cooperation with special focus on the most vulnerable countries. We focus on areas of technology cooperation benefitting the poorest communities within both adaption and mitigation. Four types of technologies have been selected, two related to mitigation (wind power and hydropower) and two related to adaptation (drought and salinity resistant crops).

Our findings and discussions will rely on:

A survey including dialogue with a selection of companies as well as industry organizations

combined with a study of the existing literature related to the topic.

With regard to the information of the private companies we have composed a sample of more than 50 companies engaged in operations which include technologies that would obviously improve mitigation and adaption efforts in developing countries. In the dialogue with these companies not all of them, however, realise how important their technologies may be for people in the least developed countries (LDCs) faced with increasingly stronger climate change affecting their lives and livelihoods.

While a number of studies with a different focus have been published on technology transfer or intellectual property rights in relation to climate change, similar studies related to developing countries and especially least developed countries are scarce in numbers. The more general studies on technology cooperation suggest a variation of views on intellectual property rights, which technologies are the more important and capacity building.

The report concludes with a number of specific policy recommendations for how to increase technology cooperation remarkably, where considerations on intellectual property rights regulation and capacity building are the main focus. Contrary to a recent EU study we find intellectual property rights partially to be a barrier and suggest that the present regulative framework may reduce or delay technology cooperation if no alterations are made.

36.3 Business Strategies for Greenhouse Gas Reduction: An Eleven-Year Industry Analysis of Actions and Trends

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Abstract As the global greenhouse gas (GHG) footprint grows to nearly half of humanity's ecological footprint, institutions, regions and nations seek effective strategies and solutions for carbon management. McKinsey, using 2007 IPCC climate data, summarizes many potential societal-level strategies and actions in their 2009 report on Pathways to a Low-Carbon Economy and present macro cost estimates in their global GHG abatement curve that guide regional and global policy. Levers involve buildings, transportation energy efficiency, power, industry, forestry, agriculture and emerging technologies. However, these macro societal perspectives provide insufficient guidance for crafting global business GHG-reduction strategies. While many case studies and sustainability reports describe individual company plans and activities at a given point in time, there is a paucity of insights that inform strategic development and evolution from data-based longitudinal studies across time involving a broad set of global corporations. This research addresses that gap. Multi-national companies operating in countries requiring Kyoto protocols have embarked on both program development and emission reduction strategies. This research uses company data from 1997 to 2007 and a path-analytic approach to describe the evolution of corporate-level organization-wide climate strategies and supporting actions used by multinational climate leaders to strengthen their businesses through reduction of energy-related GHG emissions. Findings provide insights for developing and sequencing strategic actions. The findings provide a data-derived historical framework of greenhouse gas reduction decisions for individual companies, for a cross-sectional examination of a group of companies across an industry at a given point in time, and for the evolution longitudinally both of individual companies and of the industry as a whole over an 11 year time period. Findings describe methodology by which an organization can benchmark its approach for selection, development and progress of strategies against both climate leaders and industry averages. The results also provide a foundation for more detailed climate mitigation planning and actions, and suggest further studies that inform policy and strategy professionals. This research involves an innovative method of analysis that can also be used to study policy and strategy development for other environmental issues, such as water, air pollution, waste management, chemicals, toxins and heavy metals, ozone depletion, oceans and fish depletion, deforestation, biodiversity, desertification and soils. The findings identify well established strategies that have stood the test of time, as well as emerging strategies that are growing in popularity across the industry. The visual depiction of results provides a corporate scorecard or dashboard that indicates both one's own strategic position and rates of diffusion of various activities across an industry. The approach allows for future years of data to be seamlessly integrated into current findings to embed emerging trends into the scorecard. Finally, the analysis presents a framework that allows for correlation analysis with estimates of GHG emissions to study both effectiveness of actions and the time frames required to move from development plans to realized reductions. Large multinational pharmaceutical companies provide an ideal sector for study involving a significant global growth industry with several strong contrasts that provide contextual insights to forces affecting GHG strategy development and evolution. For example, the industry spans three primary geographical regions: Japan, the European Union, and the United States, enabling comparative analysis of regional effects such as regulation and government policy. This research documents publicly reported climate strategies and the GHG emission-reduction activities of 21 large leading multinationals in the pharmaceutical industry during the 11 year timeframe, 1997 to 2007. Data sources involve publicly available information such as Carbon Disclosure Project databases, public environmental reports, websites, and board reports. The data, collected and grouped for each company and year, provide detailed information on strategies, actions, corporate sales, GHG emissions and other related factors. Affinity based content analysis of these sources revealed 20 strategies active within the industry to

reduce emissions. Strategies were categorized as either program development or emissions reduction. For example, a common program-development strategy involves an internal management system for GHG emissions, perhaps based on a standard (EMAS, ISO14001). On the other hand, purchase of renewable energy was classified as an emission reduction strategy. Program development strategies involve the establishment of plans, policy, goals and systems for GHG reduction, the evaluation of organizational effectiveness, financial analysis, measurement of emissions, and development of external resources, communicating with stakeholders, partnering with external groups and seeking/receiving external recognition and rewards. Reduction strategies address energy demand reduction actions involving green buildings and energy conservation, power strategies around purchase of renewable power, onsite generation of renewable power, use of methane, high efficiency power generation, and switching boiler fuels. Reduction strategies might also involve participation in cap and trade systems, carbon offset projects and a variety of Kyoto mechanisms. For each strategy, the authors investigated the evolutionary paths each company pursued within this industry. Evolution tracking required formulation of a metric that scored the level of development of each strategy within each company. The metrics helped identify the organizations that achieve deep deployment of a strategy by attaining a strong leadership position with that strategy. This research reveals the depth and prevalence of each strategy across the industry. For example, development of an environmental management system, stands out as the most prevalent strategy with many companies reporting strong sustained development. Several other strategies are also well-established and widely deployed with deep deployment in a significant fraction of the industry. Most well-established strategies relate to program development, with some notable exceptions, such as reduction of energy demand, improvement of energy efficiency, and switching of boiler fuels to either a renewable source or to one with lower carbon intensity. Accounting for both the year at which each strategy was deployed into the industry, the prevalence of deployment, and the depth of deployment, two types of strategies surface: established strategies and emerging strategies. Established strategies tend to be developmental while emerging strategies tend to be emission reduction, with notable exceptions. This industrial analysis charts how the Pharmaceutical sector evolved with regard to GHG reductions. These strategies represent a potential road map for other companies to consider.

36.4 Empirical Analysis of Determinants of Adoption of Proactive Carbon Strategies in India

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Proactive carbon strategies are beyond extant laws and it is important to understand why companies go beyond compliance. The paper discusses motivations behind their adoption of proactive carbon strategies in India. The research results show that institutional pressure is the most significant determinant of adoption of proactive carbon strategies. Other factors such as managerial attitude, business case of carbon investments and productivity enhancement initiatives are also significant. Based on the research findings, the paper proposes some important managerial implications in connection with adoption of proactive carbon strategies.

36.5 Case Study of the Development of CSR in Danfoss

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Corporations have come a long way from the standard financial accounting that businesses of yesteryears are used to. They are now very much aware of the need that they should also build strong public profiles and the common approach is to maintain a balance between maintaining financial stability and engaging in socially responsible activities. Corporations know they cannot simply disengage themselves from the community it is located in. As businesses become progressively more global, interactions with civil society, become increasingly broader in context. This is especially so for multi-national corporations; in which their activities, more often than not, transcends geographical boundaries and are inevitably also under international scrutiny.

This paper focuses on the CSR practice within Danfoss Group, a leading global manufacturing company based in Denmark. The private company which in 1933 started out from the attic of Mads Clausen's parents' house in Nordborg has expanded hundred-folds and it is now a global manufacturing company with over 70 factories in various locations in about 25 countries. It is also currently employing approximately 22,000 people worldwide. Additionally, Danfoss Group's products are sold and serviced internationally by a network of 115 sales companies. The expansion of Danfoss Group to other countries, as far as Asia and South America, provides an idea of the magnitude of the number of communities that Danfoss may or may not affect.

Its mechanism in CSR policy making and its learning capacity in reaction to changes that may be caused by major events (climate change and current financial crisis) and its global expansion to other countries (globalization), are central in our discussion.

As a Denmark-based company, Danfoss enjoys a comparatively more conducive socio-political environment for the development of ideas such as CSR, than developing countries such as those in Asia. The relatively strong political environment in Denmark further encourages stability in its economy and social environments. As a result, Danish companies have always been the front runners in the development of CSR practices. They were amongst the firsts to have collaborated with academia in the experimentation of ethical accounting (Giversen 2003); Sparekassen Nordjylland published the first of such social reports in 1989. Most Danish corporations are also following international CSR reporting guidelines such as the UN Global Compact or GRI Reporting Guidelines. Thus, an investigation on the integration of CSR and also how CSR is implemented in a particular Danish company could be interesting.

Based on the premises of Institutional (e.g Scott, 2001), Organizational Change (Pettigrew & Whipp, 1991) and Stakeholder (e.g. Carroll 2003) theories, a case study investigation was carried out. Information was gathered from the available reports and the accessible online materials, through face-to-face interviews and questionnaire surveys with those at management level and also to the general employees.

Using the study of Chappel and Moon (2005) as a point of departure, the CSR activities are referred to as CSR Waves, to which they reflect the alignment of CSR to the core business of the specific corporation. The three waves are categorised as Community Involvement (1st Stage), socially responsible Products and Processes (2nd Stage) and lastly socially responsible Employee Relations (3rd Stage). The methods with which the company employs to build their CSR activities are referred to as CSR Modes. These CSR Modes can provide an idea on the extent of institutionalisation of CSR in the company. The traditional way of making mere philanthropic contributions are considered the least institutionalised Mode, as compared to other Modes such as engaging in partnerships, sponsoring, adopting CSR codes and encouraging employee participation in CSR activities.

With this as reference, and also from the empirical findings, it is possible to investigate and determine the CSR Wave at which Danfoss Group is practising CSR. The CSR waves and corresponding modes are also identified to illustrate the progression of CSR in Danfoss Group, whilst gaining insights as to how it reacts to major events and the changes it goes through as well as its learning process. We could then identify the most significant theme of events (climate change, economics, or any other) which play the major role in shaping the development of CSR to what it currently is within Danfoss Group.

Keywords: CSR, Climate, Change, Financial Crisis, Globalization, Competitive Advantage

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37 Panel debate: Climate Change, Eco-Innovation, International Competitiveness and Growth

Carlos Montalvo, TNO, the Netherlands

Overview: This topic will deal with the technologies and systems needed to respond to the challenge of climate change and competitiveness. Our feeling that although there is a great deal of knowledge about a range of potential responses to the challenge of climate change there has been little exploration of what type of economic impact this range of knowledge once applied might have in the economy and growth. Furthermore, there is little exploration of the challenges to and the rules for international competition, demand conditions, supporting industries, and the structure of this 'new' industry will bring to the equation for the full deployment of services, technologies and systems oriented to mitigate climate change effects.

The issue here is that, contrary to past decades, the engagement on environmental protection (now via innovation) is seen as source of competitive advantage. Many agree on this, our feeling on this is that there is still little insight within the epistemic communities that will attend the conference on what international competitiveness entails. The "solutions" proposed after a preparatory niche development in which many climate change technologies are now, they must compete in the open market with "solutions" proposed elsewhere. For some years colleagues working within the innovation research have come closer to the environmental realm, now this is a common place. This is not the case of Industrial Organization in particular communities dealing with issues of international competitiveness.

We will see this topic coming together in the next years as governments see in the environmental challenges the possibility of creating large economic multipliers. The idea is to bring together people from the innovation (Schumpeterians), openness-competitiveness (new trade) and environmental studies traditions. The aim is to bring these issues to the attention of the communities attending the conference and draw a research agenda that addresses a number of open questions regarding the inputs, throughputs and outputs of international competitiveness in relation climate change, innovation and the environment in general.

Panelists: Tomoo Machiba, OECD Directorate for Science, Technology and Industry (DSTI), OECD; Iulia Degeratu, Public Policy Unit, Ministry of Environment; Fernando Diaz, Innovation and the Environment, TNO

47.1 The Science of Climate Discourse

Matthew Haigh[1] and Nicholas Taylor[2], (1)Department of Business Studies, Aarhus University, Aarhus, Denmark; (2)Outcrop, Fitzroy VIC, Australia

The paper juxtaposes memberships of the largest institutional investors in the Carbon Disclosure Project against investors' decisions, again en masse, to overlook the pressing problem of access of half the world's population to basic services. Zizek's theory of violence is drawn upon to characterize these decisions.

The signatory investors to Carbon Disclosure Project Information Requests include the most visible players in the overt centres of capital. CDP claims that the data it collects provides insight into the strategies deployed by investors in relation to climate change. Signatory investors have access to all CDP responses, including those that are not made publicly available. In 2009, the CDP issued a press release claiming that investors routinely used climate change data. Data gathered by the authors justify questions concerning the veracity of CDP data. It is reasonable to hypothesise that investors do not routinely use CDP data in portfolio construction except to the extent that investment horizons are adjusted in line with actuarial predictions. This is not to say that investors are well-informed. CDP signatory investors appear to have convinced themselves of the certainty of climate change based not on scientific evidence but on secondary exchanges made between each other.

While the investment houses with the majority of the world's disposable wealth wait in the wings to profit from climate change, pressing matters of access to food, clean water, and other basic services for nearly half the world's population remain chronically underfunded. The need to direct attention toward provision of access to basic services is obvious. Basic services are threefold: primary and secondary education; primary and reproductive health care; HIV/AIDS prevention, care and treatment; and adequate water and sanitation (Faulks, 2000). The World Bank and the United Nations report declining levels of access to basic services in the cities of Asia, Latin America and Africa, and disparities of access attributable to North-South and East-West divides in North America and Europe.

Pakistan and Burma provide cases in point. Low levels of access to basic services in Pakistan coincide with national levels of extreme poverty (Kimbro, 2002). On access to education, Pakistan has a low enrolment rate into primary schools (59.1 per cent in 2007) and disparities according to sex in the primary school enrolment rates of girls and boys, respectively, at 55.5 percent and 76.3 percent. Disparities in the literacy rates of males aged 15-24 relative to females are, respectively, 75.8 percent and 54.7 percent. Disparities also exist in health care according to sex and higher than expected death rates among girl children. Burma has been in dire need of improved access to basic services since data collection began. Children's access to education is poor. In 2004, 59.9 percent of children in Burma continued to grade 5 and the enrolment rates of girls and boys in secondary school were low at 36.0 and 38.0 percent, respectively. Health indicators are as poor. In 2003, the rate of use of modern contraception by married women was 32.8 percent; the maternal mortality ratio represented the third-highest rate in South-East Asia at 360 per 100,000 live births, and the proportion of average births attended by skilled health personnel was 57.0 percent.

With the exception of contractors attached to the US-led military, Western investors have fled Pakistan in response to its continued civil unrest. Although some Western investors have announced decisions to divest Burmese-related investments, most have sidestepped the economic sanctions imposed on that country An example of the former is ATP (http://www.atp.dk), a Danish labour market pension fund, which in 2008 completed a divestment of its shares in Chevron (ticker: CVX) and Total (TOT), both holding contracts with the Burmese administration-owned Myanmar Oil. In contrast, Chevron, PGGM—a Dutch health sector pension fund—and China's Cinooc and PetroChina have never divested their Burmese-related investments. Norway's Government Pension Fund, an established investor in oil-related assets, is another.

The policy of Norway's Government Fund to refrain from making investments in selected industrial sectors (e.g., arms manufacturing) and in companies accused of breaches of UN conventions on human rights appears not to extend to its investments in companies with operations in Burma. Estimates of the Fund's investments in Total and PetroChina (Chevron-owned and an investment of the Fund) are, respectively, USD1.26 billion and in USD27.9 million (October 2007). The Fund's Advisory Council on Ethics has acknowledged that human rights abuses (reportedly, forced labour and forced relocations) have been associated with the construction of the Total- and PetroChina-owned Yadana gas pipeline. The Fund's investments have been justified using argument that its investment policies have application only to current and potential future human rights abuses, not historical ones, and only to companies directly involved in human rights abuses. It is tempting to speculate on the logic behind this decision. US capital gains tax liabilities would potentially accrue to Unocal (ticker: UCL) and Texaco (TEX) (both owned by Chevron) and to Total if they were to pull out of Burma.

Such ethical difficulties potentially frustrate claims of some investors that their presence has ameliorated the problems of access to basic services persisting in many so-called underdeveloped and developed countries. Even less compunction has been shown in regard to investors' claims of responsibility associated with subscriptions to closed-ended carbon funds and memberships of information clubs such as the CDP. Many of the world's poorest countries stand to lose the most from climate change precisely because they do not have access to any form of wealth, including the ability to participate in economic opportunities. We characterize the claims of socially and environmentally responsive behaviour of the largest investors as a type of metaethics of violence. Asset allocation decisions made in pursuit of 'morally clean' prospects—clean and green energy, profitable 'cap and trade' transactions played between polluting investments—carry the morally dirty cost of overlooking the pressing needs of billions of the world's population.

48.1 Joint action on climate change in the perspective of BOP strategies.

Prabhu Kandachar, Delft University of Technology

Text Not Available.

48.2 Recommendations from Cornell Global Forum on Sustainable Enterprise

Lars Tejlgaard, BoP Learning Lab, Confederation of Danish Industry

Text Not Available.

48.3 Panel Debate: What are the challenges and opportunities from Cornell Global Forum on Sustainable Enterprise seen in the light of Joint Actions on Climate Change?

Text Not Available.

60 Presentation by Martin Klein (Business for Development)

Text Not Available.

61 Presentation by Louis Koch (BOP Innovation)

Text Not Available.

68 Plenary Session, Base-of-Pyramid

Minna Halme, Helsinki School of Economics, Finland

Presentation of key results and questions from workshops

Discussion and recommendations for future activities

13 Learning about Climate Change: Contending modes of knowledge making.

Andrew Jamison, Aalborg University, Denmark

Text Not Available.

26.1 Promoting Engagement in Climate Action: Developing Global Citizenship

Trudy Heller[1] and Dana Kaminstein[2], (1)Executive Education for the Environment, Swarthmore, PA; (2)The Wharton School, University of Pennsylvania, Philadelphia, PA

This paper begins with two assumptions: First, that untamed economic development is contributing to climate change and destroying the natural environment; second, that insufficient collective action is being taken to halt this degradation. This paper seeks to understand this dilemma by examining it through the lens of psychology, especially, Group Relations Theory. This exploration leads to practical suggestions for facilitating collective action.

Faced squarely, the loss of the natural environment evokes strong and difficult emotions. Such feelings may include: 1) Sadness and mourning for the loss of aspects of the natural environment that may never be returned to their pre-industrial state, 2) anxiety concerning future scenarios that include the dramatic uncertainties of climate change and prospects of a lifestyle lacking in such basic natural resources as clean water and air, 3) anger at those who are perceived as responsible for the degradation of the environment as well as anger at our helplessness to reverse environmental damage, and 4) feelings of apathy, hopelessness, paralysis or denial at how enormous the problem is.

No environmental problem challenges our human tendency to deny environmental impacts more than climate change. This tendency to deny environmental degradation, and, therefore to fail to take collective action to reverse and restore environmental loss is illuminated by Group Relations Theory. Group Relations Theory has pioneered the study of the ways in which social constructions help us to manage difficult emotions (Hirschhorn, 1990). This theoretical frame illuminates the question of how social structures may serve as a defense against anxiety and other feared emotions. Once defensive systems are in place, they may successfully keep troubling emotions at bay for some time, but at a cost. Defensive social structures inhibit constructive creative problem solving and collective action. They create dysfunctional systems that inhibit the best performance of organizational and social actors.

Thus Group Relations Theory is an essential perspective through which to explore the dilemma of our failure to take collective action to halt climate change and the loss of the natural environment. We begin our exploration with a brief description of relevant aspects of Group Relations Theory. We then present evidence of how the defensive mechanisms of splitting and denial are embedded in our social structures and business systems, and serve to defend us against the unpleasant emotions evoked by the loss of the natural environment.

We find evidence of these defense mechanisms in the way wealthier nations export waste to poorer countries, in the way we organize the global economy, and in some of the fundamental constructs of business education. Each of these mechanisms will be described as it serves to defend us against the difficult emotions provoked by the loss of the natural environment.

For example, business has very "successfully" developed practices, traditions; models that support our tendency to deny environmental degradation, and create the illusion that we can clean up our own space by throwing things "away." Denial is enabled by teaching incomplete, misleading business constructs.

We conclude with implications for action based on our analysis and on Group Relations Theory's tradition of practice. Solutions address the human tendency to deny inconvenient truths and to split off knowledge and emotions that make us uncomfortable. Solutions require us to develop our global citizenship, and incorporate into our home base parts of the world that have become repositories for our discarded pollutants – both physical and psychological.

International Treaties, for example, support the development of global citizenship because they focus on the world as a single, whole system. They invite us to face inconvenient truths about the loss of the natural environment. They have the potential to draw us out of denial. In order to engage climate action, we must deal with the underlying human tendencies to deny environmental impacts and loss. We must work on both a psychological level and an international level.

The Group Relations tradition uses experiential learning to raise awareness of discarded parts of ourselves, and allow us to reintegrate inconvenient truths. The paper will conclude with a description of the workshop, *One Planet Leadership: Developing Our Inner Global Citizen*, which has been designed using Group Relations methods.

26.2 Socio-Economic Empowerment : Expanded Public Works Programme : Johannesburg City Parks Case Study 2004-2008

Willie Nel, Environmental Sciences, University of South Africa, Pretoria, South Africa

The National Expanded Public Works Programme (EPWP) is a nationwide programme which seeks to draw significant numbers of unemployed into the productive sector of the economy, gaining skills while they work and increasing their capacity to earn income. The programme has been divided into four sectors (environment and cultural, social, economic and infrastructure), each consisting of a number of government departments with one department nominated to lead each sector. The Department of Environmental Affairs and Tourism has been nominated to lead the environmental and cultural sector.

The paper will focus on the initial set up and further development and implementation of Johannesburg City Parks Expanded Public Works Programme initiative with specific focus on the socio-economic empowerment of community members and emerging contractors within the Green Industries with the objective to improve service delivery and the quality of life for stakeholders.

26.3 Involving younger generation in the dialogue on Sustainable Development: Vinyl 2010 Essay Competitions and the Vinylgame

Chris D. Welton[1] and Erica A. Lo Buglio[2], (1)Vinyl 2010, Brussels, Belgium; (2)Zelian Srl / Vinyl 2010, Milan, Italy

Voluntary Commitments from industry are one of the most promising approaches to successfully bridge corporate and government roles and make effective progress on sustainable development.

Vinyl 2010 is the 10-year programme to improve PVC production processes and products, invest in technology, minimise emissions, reduce waste and boost collection and recycling, in the framework of the European PVC industry's commitment to sustainable development. This is the only Voluntary Commitment of its kind involving the entire upstream and downstream chain – from raw-materials to post-consumer waste – in a single industry.

But industry's commitments to sustainable development, cannot only be related to the strict improvement of processes and products. The European PVC industry's commitment to sustainable development includes research, dialogue, exchange of views and education.

The ongoing frank and open dialogue with stakeholders, third parties, institutions and organisations within technical, political and social communities is of paramount importance to Vinyl 2010 to exchange views on studies, experiences and good practices. But we also believe that it is important to address and engage the younger generation. Sustainable development and climate change concerns us all, especially younger generations who will have to live tomorrow with the consequences of decisions taken today.

To encourage deeper reflections, Vinyl 2010, in partnership with a number of European universities, NGOs, student associations and media, launched its first Sustainable Development Essay Competition in November 2007. Open to 18-30 year old citizens of the European Economic Area, the first competition asked entrants to respond to the question 'Are sustainable development and economic growth mutually exclusive?' in a 1,000-word journalistic essay in English.

In early 2008, entries were judged by a panel of leading European sustainable development experts from academia, NGOs and the media under the chairmanship of Mrs. Nadine Gouzée, Head of the Sustainable Development Task Force for the Federal Planning Bureau of Belgium. The judging panel was extremely impressed by the quality and creativity of the entries received. These showed not only a great interest from the younger generation on sustainable development themes but also a need of direct participation and contribution in the dialogue.

Collected together in a book published by Vinyl 2010, the full set of essays from the 2007/8 competition provides a fascinating insight into the views of a new generation on sustainable development issues. The essay book has been widely distributed to stakeholders and was presented at Green Week 2008 and at the UN CSD-16 in New York providing a unique platform for young people to express their opinions.

The prize-winners of this first competition – Maja Derčar (Slovenia), Daniela Jungova (the Czech Republic) and Francesco Falcone (Italy) – were also given the opportunity to join a panel of experts in sustainable development from the worlds of academia, media and politics in a 'Café Crossfire' debate in front of an industry audience organised in conjunction with the Brussels' based think-tank Friends of Europe.

Building on the success of Vinyl 2010 first Sustainable Development Essay Competition, which attracted entries from 14 European Member States, a second Essay Competition was launched in October 2008. This time open to young people worldwide with Ms. Selene Biffi, coordinator of the UN Major Group Children and Youth and founder of the Youth Action for Change (YAC) organisation, joining other leading European sustainable development experts on the panel of judges.

The 2008/9 competition poses the question 'Faced with a food and energy crisis, how can society improve its well-being?'

And young people from around the globe have once again demonstrated their enthusiasm for expressing their views on sustainable development issues. By the 1st December 2008 pre-registration deadline, 927 people representing 89 different nationalities from across Europe and around the world had signed up to take part in the Essay Competition. Registrations were received not only from young people across 27 states in the European Economic Area (EEA), but also from 62 other countries worldwide.

By the 31st January competition submission deadline, a total of 208 essays had actually been submitted which are now been evaluated by the Judging Panel.

Besides the final decisions and winners, all participants demonstrate a real interest in food, energy and climate change issues, with strong backgrounds, and excellent work in term of research and analysis. It is shared view that a greater level of cooperation at all levels is needed to solve such major issues and often suggested that institutions should provide guidelines for a stronger cooperation among industrialised and developing countries. Personal responsibility, commitment and behaviours, including in everyday choices, are seen as fundamental. And consequently information and education of the larger population.

Among its educational initiatives on Sustainable Development, Vinyl 2010 also developed a computer game – the Vinylgame – which challenges players to manage a virtual PVC industry in a sustainable way. Players are challenged by the daily socio-economic and environmental decisions involved in running their own PVC business. Whilst fun to play, the choices made in how the company is run illustrate the challenges in balancing economic growth with sustainable development. Within the game, the consequences of playing purely for economic growth without regarding production safety, environmental consequences or issues such as post-use recycling quickly become apparent as the virtual society may opt to respond and take actions and trade unions may vote to go on strike.

In the words of one 26 year old assistant working in the European Parliament who played the game at the Green Week 2008:

'I am really interested in sustainable business practices and this affects my consumer choices. Yet during the game, when faced with investment decisions, against a ticking clock, I managed to score a sustainability rating of only 14%. Obviously, I have some learning to do about what makes good business sense and how to create a sustainable industry.'

In October 2008, the Vinylgame was awarded the Italian prize 'Premio Aretê 2008' for responsible communication in the videogames category by a panel of judges chaired by Italian Minister of Environment Stefania Prestigiacomo.

26.4 Fighting Global Warming in Peru

Diego E. Shoobridge, Peace Corps, Lima, Peru

Peru is a country that hosts varied ecosystems and great biological diversity. It's a country of contrasts: its landscapes include the Amazon rainforest, wherein lies the country's forestry potential, the Andes mountains, with their snow-capped peaks and glaciers, and the coastal desert of the Pacific, providing important hydro-biological resources.

The increase in temperature due to global warming affects Peru in many ways. It affects the biological diversity of the Amazon; the change in temperature alters the composition and location of ecosystems. The eastern part of the Andes, covered in vegetation, hosts varied ecosystems determined basically by the altitude and the associated temperature; with an increase in altitude, temperature diminishes. Increasing temperatures will affect higher and higher altitudes, transforming the characteristics and composition of ecosystems, causing the mass extinction of species, especially plants, which can not migrate to higher elevations.

The glaciers of the Andes mountains form the rivers that flow to both the Amazon in the east and the coastal desert valleys of the west, upon which agricultural production and many cities depend. The melting glaciers are receding at an alarmingly rapid rate. This implies that both the Amazon and the coast will receive diminishing quantities of water in the years to come. In the future, the frequency of avalanches and flooding will increase during the rainy season, while the dry season will become more severe. The agricultural capacity of the coast, an important center of production for consumption and exportation, will be lost. Water will be insufficient for irrigation as well as for human consumption in the cities.

Besides temperature increases attributable to global factors, the glaciers of the Andes are additionally affected by local factors: the burning of the Amazon rainforest and, most importantly, the burning of pastures on mountain slopes generates smoke that accumulates on snow-capped peaks, altering the local temperature and speeding the melting of the glaciers. Also, intense mining in the Andes generates dust and other particulate matter that is transported by wind to the glaciers, contributing to their reduction.

The solution to global warming is to cut emissions to the atmosphere, especially in industrialized countries. In reality this is difficult due to the lack of political will to enforce emission limits. At the local level, many local initiatives can be implemented to combat global warming. One of these is reforestation in mountainous areas adjacent to glaciers.

Peace Corps/Peru, through the Community-Based Environmental Management program is promoting reforestation with various native plants in the mountainous communities where Volunteers work. Reforestation not only contributes directly to combating global warming, but also to the prevention of soil erosion, to the maintenance of hydrological processes, and to the conservation of biological diversity by maintaining habitat for wildlife. A fundamental component to ensure success in this process is the implementation of trainings and environmental education with the local population so that they consider themselves stakeholders – managing and conserving forests.

26.5 Engaging LOCAL Stakeholders IN Flood Management towards Living with Flood IN the Mekong Delta, Vietnam

Bach Tan Sinh, National Institute for Science and Technology Policy and Strategy Studies, Hanoi, Vietnam

The concept of living with flood has existed in the the Mekong Delta for many generations. Flood has not been considered as disaster when people in the Delta only live in the cities and did not cultivate rice during the flood season. Since 1975 after unification of the country the Government implemented the resettlement policies to bring people from the North to the less density areas of Mekong Delta and set up new economic zones. The problem starts to emerge then when these newly resettled people live in the inundation areas and cultivate rice three times including the one during the flood season. To cope with the harms caused by flood, a number of technical solutions have been proposed such as building the high dykes to prevent the flood, setting up a number of residential clusters to avoid people suffering from flood. However, due to the narrowly defined solutions which view the governance of flood mainly from technical aspects, thus solving one problem has led to creating another problem such as the construction of many dykes preventing flood has slowed down the flow of flood, thereby prolonging flood. Resettlement in a new residential cluster to avoid flood puts people in difficulties such as limited job creation and earning options for farmers. It is therefore not a sustainable solution.

Recently the notion of management of flood has changed from controlling flood to living with flood. the People Committee of An Giang Province has been promoting the idea of living with flood through the encouragement of local stakeholders including farmers in re-vitalizing their traditional knowledge and adaptive capacity in exploring benefits created by flood to improve their livelihoods. The Provincial Department of Agriculture and Rural Development, together with other departments and social organizations have been instrumental in assisting farmers in the An Giang Province to develop alternative livelihood options including replacing the traditional rice cultivation with other agricultural and aquacultural practices during the flood season.

The case of An Giang Province illustrates how various stakeholders (local government, civil society organizations, the international development organizations and people in Province) have been interacting to cope with the flood impacts and sustain their livelihood for present and coming years. However, the local capacity of living with flood is becoming challenged in the context of new climatic and environmental nature created from climate change and more infrastructure development in the upstream of the Mekong River.

The paper draws some lesson learned from An Giang case regarding the role of stakeholders in shaping the way the flood is managed and the implication for the national policies on flood management.

38 World café

Hanno Langfelder, Technische Universität München, Germany

Overview: Might we ask Powerful Questions that release the co-creativity of the conference participants so that in a "climate" of concern, they can express both their concerns and practical solutions for "climate" change? When we "ask" powerful questions and then get out of the way, people come alive. They reflect, they wonder, they intuit, they infer and in dialogue they discover. We propose to use a creative dialogue format as an opening, general session for the domain Learning and Climate Change. This provides a platform for meeting and engaging with similar-minded participants. An atmosphere of co-creativity, networking and productive exchange develops at an early stage of the conference – low in carbon but high in creative human energy! We aim to weave together the different themes of the domain, such climate awareness, learning and teaching climate change and produce further dialogue and exchange. Possible powerful questions for session: What success stories are in your mind when you think of Learning and Climate Change? When have you experienced deep learning? And how can we connect this with climate change? How can learning experiences contribute to actions on climate protection?

49.1 Environmental education and pro-environmental consumer behaviour – Results of a university survey

Ágnes Zsóka, Zsuzsanna Marjainé Szerényi and Anna Széchy, Department of Environmental Economics and Technology, Corvinus University of Budapest, Budapest, Hungary

The paper summarises findings of research carried out by the Department of Environmental Economics and Technology at Corvinus University of Budapest (CUB) in Autumn, 2008. The survey focuses on the pro-environmental consumer behaviour and lifestyle patterns of 350 university students and their relationship to environmental education.

Main assumptions of the research:

(1) Impacts of environmental education are reflected in consumer behaviour of students: those studying environmental subjects more intensively are more environmentally conscious in their actions. Five groups of students with distinct features regarding environmental knowledge background and motivations were surveyed.

(2) Courses on sustainability and environmental issues offered by the university significantly enlarge students' environmental knowledge base – however, their attitudes are shaped by several other factors, which are also important issues of the analysis.

(3) Reported environmental behaviour and actual environmental awareness of respondents are usually not consistent. The survey contains several control questions to test the consistency of respondents' answers. The trend is obvious: students tend to overstate their environmental awareness opposed to their real actions.

Main results are summarised below.

Asked about environmental problems, students mentioned several relevant issues; they reported their environmental knowledge to have improved significantly mainly because of university education. Active seeking of environmental information is characteristic for senior students with environmental specialisation. These students listed significantly more environmental aspects which should be taken into account during shopping or other individual activities, but they reported to apply these aspects to a different extent in their everyday life. An obvious gap could be observed between knowledge about environmental problems and actual behaviour.

Respondents consider lack of opportunities, convenience, and financial reasons as barriers to pursue a more environmentally friendly lifestyle. Consumer decisions are reported to be mostly influenced by quality and price of the product or service, followed by the aspects of availability, fashion, and lastly environment protection. Specialised students tend to include environmental issues into their decision making to a significantly higher extent than others. A higher level of consumption is restricted mainly by lack of money and time, but several respondents mentioned satisfaction with the current level of their consumption. Environmental considerations were only important for specialised students.

To describe the habits regarding everyday environmental activities and lifestyle, seven factors were identified by a factor analysis.

Hedonistic consumer behaviour: This factor includes main features related to consumer society such as shopping as a form of amusement, consumption of clothes, cosmetics, keeping pace with fashion and technological trends, being tempted by promotions, and buying things even if they are not necessary.

Environmental activist behaviour: Environmental volunteer actions (e.g. cleaning parks), as well as participation at environmental demonstrations belong to this factor.

Increase of knowledge basis: Activities like browsing environment-related websites, reading environmental books or journals, visiting environmental conferences are relevant here.

Consumption of sporting equipment and electronic devices: This factor includes the activities of its title.

Supporting environmental organisations means membership in, or financial support of environmental organisations.

Good housekeeping involves turning off the lights when leaving the room and turning off the computer when not in use.

Not leaving electronic devices on stand-by

Based on the identified factors, respondents were grouped into five clusters (using Ward method):

Cluster 1: Sport and electronic device fans (120 students) buy these items significantly more frequently than others. Not surprisingly, two third of all male respondents belong to this cluster. Other hedonistic consumer patterns are not really characteristic for this group, but they spend relatively more money on consumer goods (excluding food and housing) than the average. Following fashion and technological trends are an important motivation in their consumer behaviour. They use their car beside public transport, and they seem not at all influenced by environmental aspects in their consumer behaviour or lifestyle.

Cluster 2: Knowledge-oriented modest students (42 respondents) are characterised by their intensive information seeking habits related to the environment. They are modest in their consumption and lifestyle, consuming the least in the sample. They reported to only buy goods which they truly need. On the other hand, they are not at all interested in the activity of environmental organisations. Members of this cluster are mainly students specialising in the environmental field. They were able to mention several environmental problems and environmental aspects relating to consumer/everyday behaviour, and appear to lead an environmentally conscious life.

Cluster 3: Consumption-oriented students (128 respondents) show a quite hedonistic value system, as they enjoy shopping, follow fashion trends, and like to spend on clothes and cosmetics. The majority of them are female, not specialising in environmental issues in their studies. They seem not to care about the environment, either in information seeking, or in activist behaviour, and consider environmental aspects in their everyday life significantly less than the average.

Cluster 4: Environmental activists (16 students) are often members of environmental organisations and are eager to take part in demonstrations and volunteer activities. This attitude is also reflected in their lifestyle, as they are engaged in composting, cycling, walking, minimising waste, saving water and energy etc. Their consumption level, however, is around the sample average. Their pro-environmental behaviour is most probably based on affective motivations, as they are not keen on increasing their environmental knowledge. Fourth- and fifth-year students with environmental specialisation are well overrepresented in this group.

Cluster 5: Environmentally aware students (15 respondents) consume significantly less than the average. They appear unaffected by promotion and marketing tools, buying goods according to their needs. They occasionally participate in environmental demonstrations without being members or supporters of environmental organisations. They were able to mention several environmental problems and environment-related consumer and lifestyle patterns (significantly more than the average). Interestingly, they reported to have everything they need while they spend less than the average on consumer goods.

As can be seen above, the findings of our research can be used to describe environment-related consumer behaviour of students and to reveal the main underlying reasons, as well as for evaluating the effectiveness of environmental education and identifying the main points for improvement.

49.2 Universities and transition to sustainable development: lessons from the Costa Rican case

Jeffrey Orozco, Cinpe, Universidad Nacional Costa Rica, Santa Barbara, Heredia, Costa Rica

The rhythm and direction of innovation and technological change are key factors to determine the possibilities of a country to get the challenges of sustainable development. The challenges are multiple and diverse. Some are related to the economic dimension and in a clear link with growth. But other challenges are related with social issues, including health, income distribution, and access to opportunities, education and similar goals. The eco-system is also part of the dimension. The study of development is not an abstract task. Actually, development in general and more concretely the technological and economic progress of a country is normally based on the system of innovation. Stressing on the necessary transformations it is possible to establish the link between the debate about sustainable development and the debate about *systems of innovation*. Actually, most of the key questions in the study of systems of innovations are related to the explanation of why nations differ in economic performance, including the environmental dimension.

Different actors play a role in the transition process. For example, universities are relevant components of the system of innovation. In countries where most of the firms are small or medium size, universities can be very useful for the development of technology. They can contribute to de design and transfer of technologies with better environmental performance in sector where firms have difficulties to develop this kind of technologies. However, the knowledge developed by universities is useful for firms only in certain conditions. In order to appreciate the role of universities and public research centers on innovation processes by firms, it is important to have a systemic approach. It is essential to note that universities and public labs are not only the source of personnel trained in science and technology fields. In a number of industries they are also a source of scientific and technological knowledge relevant to the innovative activities of firms, and research and problem solving capabilities that can be directed to problems relevant to firms. These knowledge and capabilities provide a broad support to the innovative activities of business enterprises. In turn, firms, while trying to identify solutions for technical problems and bottlenecks in the context of their innovative activities, provide universities with demands that may lead to new research questions, scientific findings, dissertations, papers and others.

A relevant finding is that most of the effort of R&D in the Costa Rica is done by universities. Firms also have R+D but few of them have a formal department. Because of that, it is crucial to understand new mechanisms of contribution of universities to industrial R&D. Firms in Costa Rica have concentrated in few objectives for the interactions with universities. The main have been to contract research that firms can not develop and to contract useful activities into the innovation processes by the firms. Support in processes of quality control has been also relevant. Firms recognize that university's laboratories and other resources that can be very useful to facilitate innovation processes for firms. However, the interactions between universities and the industry are still relatively week. The paper reports the results of two surveys, one to researchers in universities and public research institutes and one to firms, both in Costa Rica. Some results indicate that the key channels through which university research impacts industrial R&D include published papers and reports, public conferences and meetings, informal information exchange, and consulting. The main mechanisms are training and information. Although the average of firms having interactions with universities is low; most of the firms with this kind of interactions are satisfied with the results.

The barriers for stronger interactions are different for firms than for researchers. Firms mention mainly a week joint agenda, but researchers mention that bureaucracy at research centers and universities hinder the interactions with firms. The fact that most of the firms in Costa Rica has innovation activities aimed mainly to incremental innovations -as improvements in products and small changes in processes-, can also be a factor hindering stronger efforts joint projects in R+D. To complement the analysis, the paper report on several successful cases on the interactions between universities and the industry, especially in biotechnology projects. One conclusion is that Costa Rican universities are contributing to the development of local capacities for sustainable development, mainly for their contribution of scientific and technological knowledge. However, the links with industry are still weak and hindered by several obstacles. Researchers in universities are improving their capabilities, but the amount of researcher and the time they have for research are not enough. A strong difference with respect to universities in developed countries is that there is not a culture of patenting. The lack of patenting has not been compensated by other kind of institution to promote the appropriation of the results of R&D projects. This lack of institutions is an obstacle for the interaction with the industry because both, universities and firms, feel uncertainty and distrust about the appropriation of results. Firms are reluctant to finance joint R&D projects with universities. The mechanisms of technological transfer are limited then to few general strategies, as seminars, exchange of free information and similar, but not to joint projects. In this context, universities should find new strategies for interaction with the industry if they want a stronger contribution to the transition to sustainable development. The contribution is crucial in Costa Rica; with a predominant presence of small a medium firms without R&D departments.

49.3 How to rank universities from sustainability perspective?

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Ranking of universities is a global phenomenon with more than 25 years of history. Higher education ranking tables are published not only by the private and media-based sectors, but also by the professional associations and governments (UNESCO CEPES, 2007). Many ranking tables exist to evaluate performances at universities, using various indicators in order to objectively assess the excellence of universities. Most designers of rankings tables have started by collecting data of the universities that are believed to be indicators of quality. After allocating each a different, predetermined weight, the indicators are added-up to give a total score that determines a university's rank. But there are vast differences between ranking tables in number and nature of indicators, as well as the way the data are obtained (Enserink, 2007). Rankings have been criticized for questionable and flawed methodologies. Marginson (2007) argues that ranking tables conceal a whole array of methodological problems and anomalies. It is often unclear why a particular definition was chosen, how well it was founded, by whom it was decided and how open and reflective the decision process was (RFSU, 2008). Furthermore, existing rankings generally have numerous inaccuracies. They do not include teaching quality, student outcomes, lifelong learning, e-learning. Also, assessing the impact of educational process on students is so far an unexplored area (Altbach, 2006). Academic Ranking of World Universities (ARWU) and Times Higher Education Supplement (THES) ranking tables exhaustively compare the research achievements (number of citations, number of scientific publications) of universities. On the other hand THES only marginally touches the quality of education. Therefore, universities focusing on social sciences, humanities and engineering suffer under ARWU and THES ranking systems and occupy lower positions. Indicators, such as knowledge transfer, number of published textbooks or patents are not taken under consideration. These two ranking tables also do not consider the environmental issues of universities. In contrast, many environmental problems, such as pollution, climate change, and non-sustainable consumption exist, and many universities are monitoring their environmental footprints.

This paper introduces a model, which would enable a comparison between universities regarding economic (research expenditure, highly cited researchers, etc.), social (graduation rate, foreign student's rate, etc.) and environmental performances (environmental commitments, sustainability or environmental oriented programmes, etc.). The purpose is to provide simplified information about the qualities of the universities regarding sustainable development issues. This model enables a quick detection of the weaknesses, advantages and improvement options for universities. Weights of indicators were determined with an analytical hierarchical process (AHP). Results of the AHP have shown that the most important are research oriented indicators, followed by social and environmental ones.

The model will be tested on a sample of at least 20 top universities from the ARWU and THES ranking tables, published in 2008. These results are to be compared with the results of the 20 best ranked universities from the ARWU and THES ranking tables, published in 2006, in order to follow their improvement, regarding sustainability issues. As a result, a new ranking table is to be designed, where more sustainable universities will be placed in the higher positions. In addition, correlations will be carried out between indicators and ranking tables.

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50.1 EDUCATION IN Environmental Sustainable Architecture for the FUTURE? – for A Joint CLIMATE Action

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Abstract:
Architects and engineers in the building and construction industry are today facing great challenges due to the fact that energy consumption will have to be reduced to a considerable degree within the next few years in order to ensure that no further damage is done to the global environment from new buildings. The industry is thus facing major changes in terms of public regulation and in the way building and construction is carried out in practice, whereby "bad habits" seen in relation to an energy optimization of the building will have to give way to new and better methods.
The paper will present a teaching method used for the Architecture specialization at the Architecture & Design education. It is tailored to deal with current societal/technological, environmental and sustainable issues. In terms of both research and teaching, Aalborg University utilizes an interdisciplinary approach to a considerable extent. At Architecture & Design at Aalborg University, we have been working with environmental sustainable architecture since 2000 -02. We use a model called the Integrated Design Process (IDP) for that purpose, which is a hybrid method of designing integrated architecture in an interdisciplinary approach between architecture and engineering [1,2]. The IDP focuses on combining architecture, design, functional aspects with engineering parameters like energy consumption, indoor environment, and construction in order to achieve a more holistic approach to sustainable environmental architecture. The goal is to reduce the use of energy for heating and cooling and bringing down the emission of CO_2 by reducing the amount of fossil fuel consumed by the built environment already in the early stages of the design process.
Aalborg University has since 1997 offered a full graduate programme in Architecture & Design (A&D) as an engineering education with specialization in Architecture. Since 2005 the master has been offered in English. The curriculum is organized so that lecturers of architecture and design from the new and more aesthetically oriented Department of Architecture & Design would teach the core competencies of their professions in a well-balanced blend supported by lecturers from departments of technical science at the university [3]. Achieving a successful blend of the different professional attitudes and traditions was a sometimes difficult process, but today some of the barriers between these fields have been opened and replaced by cooperation.
The paper will discuss a similar barrier amongst Danish architects and building engineers, who both traditionally lack elements of inter-disciplinary integration in their curricula. The lack of technical skills in the existing architectural degree courses has been the subject of continued criticism. Recent government reports also conclude that the traditional programmes, at the schools of architecture, should be better tailored to the needs of the professions. [5,6] Thus, for many years, the technical scientific aspect has been practically non-existent in such courses. The technical scientific aspect of design has been taught only in courses of engineering, which have in turn all but ignored the aesthetic dimension during the 20th century.
Such a segregation of arts and technical science can create prejudice and a lack of professional understanding between courses of study in engineering and design respectively, and has left graduates with not only very different methods and tools, but also very different terminologies, language and professional self-understanding – almost as if the graduates come from two different planets [2,4]. This can be seen as a hindrance in developing products and architecture in a more complex and holistic design process where the integration of both technical and aesthetic aspects is important.
One of the major obstacles in today's education at A&D is the lack of tools, which allows the designers to use their knowledge about how to reduce energy consumption, in the early design phases, especially in larger complex projects. Present engineering tools are specialized and very detailed [7], making them difficult to use for designers. Furthermore these tools do rarely possess an interoperability with

traditional digital CAD tools used for modelling [8], making the integration and evaluation of the different parameters more difficult than necessary.
Today, engineering graduates from AAU are highly valued in industry, typically because their expertise in group work and their focus on problem-solving in context are well developed in comparison with graduates from traditional engineering and architecture courses of study and they are prepared and updated to build low energy and zero energy buildings.

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50.2 Auditing Cardiff University's curricula using the STAUNCH© system for sustianable events

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During the last decade many efforts have been made to engage higher education institutions in Sustainable Development (SD). Such efforts call for SD to be incorporated into research, operations, outreach, assessment and reporting, and to the core of universities and colleges: curricula.

Although different tools are offered to help to incorporate SD into existing curricula, to date there has been no comprehensive means of developing an overall curricula analysis, which would cover how well specific SD issues are covered by particular schools or courses and what gaps or areas of weakness might exist

For this purpose, the Sustainability Tool for Auditing UNiversities Curricula in Higher-Education (STAUNCH©) system was developed. STAUNCH© is intended to help universities to audit their curricula from a Sustainable Development perspective based on courses' description.

STAUNCH© has four steps: 1. Criteria selection, 2. Data collection, 3. Data input and grading against the selected criteria, and 4. Analysis and results of degrees, schools, and the university's contribution to SD.

The grading in done against 36 criteria, which are divided into the traditional three-top level SD categories (economic, environmental, and social aspects), with an additional category named cross-cutting themes, referring to those topics that touch upon the previous three, e.g. governance, and people and part of nature.

The scale used for the criteria is presented in Table 1 . Note that the second column presents what the grade means to the Disciplinarity issue[1]. This is done for all of university's courses.

Table SEQ Table * ARABIC 1 Grades used for the assessment criteria

Grade	Normal categories	Disciplinarity
[BLANK]	Not related/mentioned	Mono-disciplinary
1	Weak relation/mention	Multi-disciplinary
2	Medium relation/mention	Inter-disciplinary
3	Strong relation/mention	Trans-disciplinary

Once the courses are graded, STAUNCH© analyses the results and provides an inbuilt report with a summary to highlight the relative strength and depth of coverage of SD within the curriculum for degrees, schools, and the whole institution.

It also provides the results in graphical form, which can help to demonstrate the extent to which for whole Schools/Departments, their degree schemes, and their specific courses/modules address SD issues; and the relative balance between economic, environmental, social and cross-cutting SD issues.

The analysis allows the 'breadth' and 'depth' of coverage of sustainability issues within the curricula of different schools within an institution to be plotted in a systematic and consistent way. Thus providing useful information to those seeking to tackle the challenge of integrating sustainability issues more strongly into teaching. It also encourages the development of a more synergistic approach to sustainability.

STAUNCH© was successfully piloted in 21 of Cardiff University's 28 schools. The analysis of over 5,800 provided interested insights into the how SD is currently being addressed in Cardiff University's curricula.

The results showed that around 30% of the university's courses contribute to SD, where the contributions are mainly low. The main focus in the university is on the social aspects, whereas environmental aspects are the ones least being considered.

The results were the key results from the analysis. The contributions to SD from the schools can be divided into:

- 9 schools with low contribution and balance (from 0.5 to 1);
- 7 schools with relatively middle contribution and balance (from 1 to 1.5);
- 5 schools with relatively high contribution and balance (above 1.5

In regards to the percentage of modules contributing to SD, the schools can be divided into:

- 8 schools with relatively few modules relating to SD (0 to 20%)
- 8 schools with some modules relating to SD (20% to 40%)
- 5 schools with high number of modules relating to SD (over 40%)

CU's schools vary considerably in how teaching is connecting to SD, and they appear across all the spectra of depth of contributions and balance. This suggests that currently CU's curricular contributions to SD are approached from a portfolio perspective, where each school specialises in the SD issues that are most central to their discipline, or areas of discipline, without necessarily relating these to the broader SD context or other SD issues.

One of the most important conclusions learnt was that SD should permeate throughout the university and be seen beyond a "portfolio" of schools. The results from the exercise helped to demonstrate that SD needs to be addressed through balanced, synergistic, trans-disciplinarity and holistic perspective, and not through compartmentalisation, over-specialisation, and reductionism.

The results from STAUNCH©'s audit of Cardiff University can be used as a results can help other universities to engage in auditing their curricula contributions to Sustainable Development, and look for ways to better integrate it into their systems, and be better aligned with the DESD.

STAUNCH© was shortlisted for the Times Higher Education 2008 awards. It has been successfully piloted in all the universities in Wales. Worcester University, UK, and Monterrey Tec, Mexico, are also starting to use it.

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[1] For a review on Disciplinarity see Lozano, R. (2006). Incorporation and institutionalization of SD into universities: breaking through barriers to change. Journal of Cleaner Production, 14(9-11), 787-796.

50.3 Integrating Sustainability in Engineering Identity

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Education for sustainable development (ESD) has increasingly come to the fore since the term was highlighted and launched as a UN action point with the Decade of Education for Sustainable Development. A far-reaching undertaking meant to address sustainability in education at all levels, the Decade acts as a normative framework for promoting a number of didactic objectives including interdisciplinary learning and critical thinking. In higher education, ESD has been the subject of much attention as regards experience-gathering on how to incorporate sustainability in practice, see for instance Lidgren et al. (2005) and Moore (2005). The imperative for an increasing focus on ESD is made clear by Barth et al. (2007) who point out that ESD in higher education is made all the more important because, set against a backdrop of globalisation and increasing complexity, there is a need for enabling people to not only generate and acquire knowledge, but to "… reflect on further effects and the complexity of behaviour and decisions in a future-oriented and global perspective of responsibility". Along the same vein, this paper relates ESD and its further implications for personal and professional identity with the concept of Bildung in the specific context of engineering education at Aalborg University - Bildung, for which there is no direct translation in English, being a concept closely tied with identity formation. Aalborg University, an institute of higher learning that has chosen to pursue an overall learning strategy of problem-based learning (PBL), holds a UNESCO chair in PBL and has an interdisciplinary basic course (first year) for engineering students. Aalborg University is also beginning to lift off on on-campus environmental management initiatives, and this paper will seek to reflect upon how Bildung for sustainability can be seen in relation to product-oriented environmental management.
This paper reports on the experiences with engineering education for sustainable development in the problem- and project-based learning environment established at Aalborg University. In this context the students work in groups approximately 50 percent of their time preparing a problem-based project. The learning outcomes are three-pronged at the first year of every engineering study programme encompassing technical, process-oriented and contextual knowledge respectively. The students work in project groups of some 4-8 students for about 3-4 months each semester, and they document their work in a report (approximately 80-100 pages).
To support the projects, each of the three distinct learning outcome areas have courses which are evaluated at an individual oral exam based on the student's group-based project documentation. The 2 ECTS course Technology, Humanity and Society (THS) is provided to support the integration of contextual knowledge into the project work. In specific relation to engineering education for sustainable development in Aalborg University's project-oriented setting, the THS course provides a framework for contextualising a specific technical solution in relation to its implementation and use through both technological, humanistic and societal perspectives and it allows the students to experience the need to address such issues as environmental regulation, eco-design, environmental impact assessment and social responsibility in relation to a specific technology. The learning philosophy is that the students thereby become more likely to consider the social and environmental aspects as an integrated part of their professional identity and thereby consider the learning meaningful.
In this paper, we draw on students reports to exemplify approaches to sustainability in their engineering projects. These examples are discussed in relation to the concept of Bildung in engineering education, which can be described as an educational and philosophical ideal that centres on the question of what constitutes an 'educated' or 'cultivated' human being (Biesta 2002). Wolfgang Klafki has contributed considerably to the conceptual development of Bildung by his concept of Kategoriale Bildung. Using this concept, Klafki emphasises the interaction between the individual and its surroundings in the constitution of Bildung, which is where the concept can be linked to sustainability, and underscores two main points. First of all, Klafki points out that the classical concept of Bildung and its principles - self-determination, freedom, humanity and general public education - are too idealistic when considering

social structures and inequalities. Faced with this, he calls for a political aspect on the constitution of Bildung characterised by active, participatory democratisation. Secondly, and in line with the concept of exemplarity, he argues that Bildung has to ensure that contemporary societal problems are addressed. As examples he highlights the questions of peace, ecological sustainability and social impact of technical innovation – examples of problems that certainly haven't lessened in importance or magnitude since Bildung was first conceptionalized.

Based on this discussion we argue that a problem-based learning environment with a curriculum emphasising societal contextualisation of science and technology is a driver, but not a guarantee for what can be called Sustainability Bildung. The studied student project reports show examples of how tools can be applied in the name of sustainability borrowing from environmental management studies e.g. students making an environmental screening of a product to consider the potential environmental impacts. The question is whether the application of such skills and tools should be the foundation for engineering education for sustainable development, or should the goal instead be to facilitate engineering students to integrate sustainability into the engineering mindset itself – reflecting the role of sustainability in relation to themselves, their engineering profession and to society. This question has important implications for setting up 'product oriented' environmental management at campuses where deeper ESD can take place for designing not only engineering programmes, but for others as well.

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62.1 Simple and painless? The limitations of spillover in environmental campaigning

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The comfortable perception that global environmental challenges can be met through marginal lifestyle changes no longer bears scrutiny. The cumulative impact of large numbers of individuals making marginal improvements in their environmental impact will be a marginal collective improvement in environmental impact. Yet we live at a time when we need urgent and ambitious changes. If those in government, business or the third sector persist in advocating 'simple and painless' behavioural changes as a meaningful response to today's most pressing environmental challenges, this must be because they are persuaded that such changes will encourage the adoption of other, and particularly other more ambitious, behaviours. The effect by which adoption of one pro-environmental behaviour may increase people's inclination to adopt other pro-environmental behaviours, including political engagement, is known as 'positive spillover'. The particular instance of positive spillover where a behavioural change increases a person's inclination to adopt a second and more ambitious behavioural change is called the 'foot-in-the-door' effect. Insistence on the use of positive spillover (and particularly foot-in-the-door) strategies legitimises a reliance upon simple and painless behavioural changes, and has undeniable attractions: it can serve to deflect pressure for government to adopt ambitious and potentially unpopular policies and regulations; it allows businesses to claim they are contributing meaningfully to engaging a problem such as climate change through the sale of compact fluorescent light bulbs or washing-lines; and it helps to relieve environmental NGOs of the (potentially upsetting) obligation to draw attention to the full scale and urgency of global environmental problems. These attractions perhaps go some way to explaining the continued reliance placed on positive spillover and foot-in-the-door, even though the empirical evidence for the effectiveness of these strategies is highly contested. While some researchers suggest that pro-environmental conduct has a tendency to spillover from one behaviour to another, others argue that when people engage in pro-environmental behaviour (perhaps a simple and painless step), they often use this fact to justify not doing other (perhaps more environmentally significant) things. Yet other researchers emphasise the uniqueness of every pro-environmental behaviour and downplay the possibility that pro-environmental conduct in one area will have any implications – whether positive or negative – for the likelihood of acting pro-environmentally in other areas. The empirical evidence for spillover – both positive and negative – and the theories offered to explain these results are reviewed. We do not argue that positive spillover and foot-in-the-door effects cannot occur – clearly they do, at least under some circumstances. However, we do not find evidence that positive spillover and foot-in-the-door effects occur with the dependability that would be necessary to responsibly advocate their use as a major plank in engaging environmental problems (such as climate change) that require urgent and ambitious interventions. It seems very dangerous to premise environmental campaigns on an insistence that the adoption of 'simple and painless' steps will necessarily spillover into ambitious behavioural change proportional to the scale of the challenge. Our concern is that, at present, many campaigns for small and environmentally insignificant behavioural changes are tacitly justified through an unexamined assumption that these will contribute to delivery on more ambitious and environmentally relevant changes. Environmental campaigners should be clear with themselves about whether a campaign is aimed at delivering a specific behavioural change (the actual focus of the campaign) or whether it is aimed at helping to elicit a wider set of behavioural changes (through positive spillover effects). This discipline would oblige campaigners to be clear about two things: first, the inadequacy of responses to environmental problems that rely upon widespread adoption of marginal reductions in individual carbon footprint; and second, the challenges facing them if they are to use such campaigns as vehicles for promoting more ambitious changes. Notwithstanding this overall conclusion, we reflect on the implications of research in spillover for the design of environmental communications and campaigns, with a view to optimising the possibility of positive spillover occurring. This leads to a series of recommendations. A central conclusion is that the reasons underlying the adoption of a particular behaviour have an important bearing on an individual's inclination to adopt further behavioural changes. In particular, an appeal to environmental imperatives is more likely to lead to spillover into other pro-environmental behaviours than an appeal to financial self-interest or social status. This contradicts the insistence, often made by campaign advisers, that environmental communicators should be indifferent to the reasons they use to urge behavioural change. At least to the extent that a campaign aims to encourage spillover into other behaviours, the reasons given as motivation for the initial behaviour are likely to be very important. Moreover, in striving for clarity about the reasons for advocating a particular behavioural change, it is important to focus exclusively on the environmental imperatives. Appealing simultaneously to several incentives (e.g. the financial savings and environmental benefits arising from energy-efficiency measures) is likely to reduce the instance of positive spillover into other pro-environmental behaviours. In the final section of the paper, we examine the possibility that, as a result of engaging in simple and painless behaviours, individuals may be more accepting of proposals for government intervention to enforce these and other pro-environmental behaviours. There is little evidence from empirical studies to draw on here, but we propose that the reasons given to incentivise the initial simple and painless behavioural choices are again likely to be important. In general, we speculate that an individual who has experienced a degree of cost or inconvenience in the course of voluntarily adopting a pro-environmental behaviour for environmental reasons will be more likely to support government interventions to enforce that behavioural change more widely than will an individual who adopts a behavioural change for self-interested reasons. Finally, we reflect briefly on the effect that campaigns for 'simple and painless' voluntary behaviour changes are likely to have on public attitudes towards ambitious new government interventions, even when these are framed in explicitly environmental ways. Unfortunately, there is currently a lack of evidence to discriminate between the possible effects that 'simple and painless' campaigns may have on these public attitudes.

62.2 Learning through climate awareness raising campaigns: from strategy skepticism to action competence

A. Kenis and E. Mathijs

Text Not Available.

62.3 Environmental Awareness through Performative Urban Media

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The paper bridges several of the themes at the "Joint Actions on Climate Change" focusing on the abilities for interactive urban media to encourage a sustainable lifestyle by establishing environmental feedback loops through collective urban media affecting individual sustainable behaviour.

Through the recent climate debates sustainability has been approached as a much more integrated issue where the balance of natural resources and climate exists in close relationships with the collective actions of the global population. Here sustainability is now perceived as in a feedback loop with human behaviour and nature no-longer perceived as a setting that is forever determined in its own balance. This opens up a new framework for how to realign natural and cultural goals through new performative experiments that bridges environmental agendas with cultural lifestyles by introducing information technology to circulate feedback between cause and effect. These performative dialogues and new technologies are important for any culture, but getting increasingly important for a society, which behaviour is continuously guided through new collective media.

The paper presents a series of current projects, however emphasizing two projects that introduce performative urban media as a way to circulate sustainable information to influence sustainable consumption patterns. The first project is a research project that investigates how interactive lighting can lower energy consumption and encourage sustainable behaviours through sensor technologies embedded in urban street lighting. The second project is an experimental project investigating how new types of media facades can increase environmental awareness through specific feedback between citizen and consumption data through a setting at an industrial area in Aalborg.

69.1 Experiences from a reform project on education for sustainable development at Chalmers University of Technology

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Chalmers University of Technology (Chalmers) is a private university in Göteborg, Sweden, with about 9,000 students on Bachelor and Master level in the engineering and architecture areas.

Chalmers is actively working on improving learning for sustainable development (SD) in its

educational programmes. The present vision of the university reads "Chalmers - for a

sustainable future", which shows the strong commitment to these issues, in education as well as in other activities. The strong commitment in the university management is not the only driving force for improving education for sustainable development (ESD) at Chalmers. Since 2006, the Swedish Higher Education Act states that universities in Sweden should promote SD in all their activities. The Swedish Degree Ordinances for engineering, architecture and some other degrees also contain requirements on student learning related to SD.

At Chalmers, the choice has been to strive to include SD into all programmes. There is a local requirement (that originates from a policy created already in 1985) that the Bachelor curriculum in all educational programmes should contain a compulsory course of five full-time weeks of studies, i.e. 7.5 ECTS, focusing on environment and SD. An additional local requirement is that all five-year programmes must include 7.5 ECTS of courses in humanistic and social sciences (excluding economy and languages). There is a connection and some overlap between the two requirements and together they cover environmental and social aspects of SD.

In order to review and strengthen its ESD activities, Chalmers launched a three-year ESD

project in July 2006 (http://www.chalmers.se/gmv/EN/projects/esd_chalmers). The aim of the ESD project is to suggest an organization for handling issues related to learning and ESD, e.g. concerning continuous improvement of the quality of courses, and providing support and information to various actors. The aim of this paper is to share experiences from the ESD project in order to give input to other universities in their ESD work.

The ESD project is directed towards nine action lines, and different subprojects have been performed, each targeting one or several action lines. The people who are taking part in the ESD project, such as programme directors, teachers, study advisors, the environmental officer, and students, do it as part of their ordinary roles at Chalmers. Some important characteristics of the methods used in the sub-projects are:

- Backcasting approach, in which goals and visions are clarified before actions are taken in order to direct actions in this direction;

- Individual interaction, in which learning processes have been started in as many individuals as possible through active meetings and discussions;

- Approaching all levels in the educational organization in order to influence management level and programme level as well as course level and to gain support and create legitimacy for the work.

Sub-projects or activities in the ESD project can be divided into those that are aiming to:

- Create joint goals and visions: e.g. development of a text describing intended learning outcomes for compulsory basic courses for environment and SD, and discussions of what is meant by quality in ESD;

- Analyze present state: e.g. an inventory and evaluation of present courses, both from a teacher and student perspective;

- Support and create incentives for going from the present state towards goals and visions: e.g. collection and publishing of good teaching examples, a resource group that can support teachers or programme directors in integrating SD in courses and programmes.

- Elaborating means to improve and forms to present qualifications in ESD for teachers, programme directors and others.

The most important part of the fulfillment of the overall aim of the ESD project, *to suggest an organization for handling ESD issues,* is that a new centre on learning for SD in engineering sciences has been started at Chalmers. The purpose of the centre is to strengthen learning for SD within engineering sciences by spreading information, supporting and organizing different activities, and starting up research within the field. Efforts will address internal learning activities at Chalmers as well as public learning and learning in elementary and high schools. The centre will take on the main responsibility for ESD issues at Chalmers and will act to implement the suggestions that are brought forward by the ESD project when it ends this summer.

An important insight, which is recommended to other universities is that any ESD reform work in a university is a long-term process that preferably should be integrated into the ordinary organization of a university in order to remain a concern for all also when short-term projects have ended.

P1.1 Barriers and possibilities for the emerging alternative lighting technologies

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20% of the total electricity produced in the world today is used for illumination. Though the use of energy in Europe *almost* stagnated during the 1990ies, studies reveal that for the next 30 years the consumption of electricity will again increase making the 20% reduction of CO_2 goal almost impossible to achieve and this will even only represent 2-3% of the world's total CO_2 emissions. Despite the appearance of many energy-saving devises in the 1990ies, the Living Planet Report of 2006 highlighted that humanity´s Ecological Footprint, our impact over the planet, has more than tripled since 1961. This report indicates that our footprint now exceeds the world's ability to regenerate by about 25 percent. Many initiatives are, however, taken to work towards the formulated CO_2 reduction goal. One important example is that compact fluorescent lamps currently are in the plans of many countries to phase out the incandescent lamp; However, the emergence of other illumination technologies such as Light Emitting Diodes (LEDs) are currently raising in question, whether the fluorescent lamp is the technology that best can reduce the (large) illumination ecological footprint. Europe and more specifically Denmark, a country with a strong experience on photonic technologies, could contribute in reducing the lighting ecological footprint due to its human, and physical capitals related to this industry. Still Europe struggles with the paradox of losing productive jobs in this sector. This study will explore the question: What are the main possibilities and limitations for the Danish lighting Industry to help reducing the global illumination ecological footprint and what can be improved in the current illumination value chain in order to use the possibilities?

P1.2 Climate and Environment

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The Hague University of applied science starts a new Bachelor degree education under the title: Climate & Environment

Climate change is a hot item nowadays. The whole world is very engaged in this subject. The climate is becoming more extreme, heavier and more hurricanes, heavier and more frequent rain storms, longer dry periods, higher average year temperatures, etcetera.

The main causes of the climate change are the greenhouse gases increasingly produced on account of our ever growing energy demands.

Will science and engineering be able to solve climate problems, the growing scarcity of clean water throughout the world and will they find economically sustainable energy sources?

Will people understand the necessity to adopt a more sustainable life-style and stop wasting away energy and water?

Universities are playing a very important role in the transformation to a sustainable world.

The paper starts with the question: How to deal with climate change in the built environment?

One of the main issues in the perspective is government policy.

The policy focuses on two tracks:

¥ Reducing CO_2 emission (mitigation)

¥ 8% reduction in EU 2008-2012

¥ 30% reduction in NL1990-2020

¥ Adapting to climate change (adaptation)

¥ Anticipating on a sea level rise of 1,30 m in 2100

¥ Anticipating on extra river flow in Rhine and Meuse

The main subjects of the new education:

¥ What can be done to reach the CO_2 emission goals in the built environment?

¥ How should we adapt our country to new this new climate?

Some examples will be discussed:

Example of innovation in house-building

Example of changing landscape

Job perspective

¥ Climate and energy

¥ Sustainable products and systems

¥ Environmental engineering

¥ Water management

P1.3 Stockholm County Council's unique work with reducing emissions of nitrous oxide used in health care

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In Sweden, nitrous oxide (N_2O, laughing gas) is widely used as a mild anaesthetic by mothers in delivery work and the method is very positive from a medical point of view. Nitrous oxide also is a very potent greenhouse gas with a GWP of approximately 300. Therefore, emissions of nitrous oxide from health care must be strongly reduced in order to minimize their contribution to the increasing greenhouse warming. In 2002, Stockholm County Council emitted 34 tons of nitrous oxide (equals more than 10 000 tons of CO_2) to the atmosphere, the majority coming from delivery wards in hospitals. In the Stockholm County Council Environmental Policy Program for 2007-2011, one of the objectives includes reduction of the emissions of nitrous oxide. The goal is set very high. By 2011, the emissions should have decreased by 75 % compared to 2002.

To reach this goal, many different measures must be taken. The most important one is to destroy the used nitrous oxide by splitting it into harmless nitrogen and oxygen. The world's first destruction facility for nitrous oxide at hospitals, Anesclean-SW, was purchased by Stockholm County Council in 2004 and installed at the Karolinska University Hospital at Huddinge in Stockholm. It provides a removal efficiency of the incoming nitrous oxide in excess of 95 % and destroys about 2 500 kilos of nitrous oxide per year. From 2002 to 2007, the total emissions of nitrous oxide by Stockholm County Council were lowered by 25%, to large extent the result of the installation of Anesclean-SW in 2004. To further improve this result, a second destruction facility was purchased in December 2008 and three more are planned for.

A LCA (Life Cycle Assessment) shows that there are no negative environmental effects reducing the positive impact of a diminished greenhouse effect.