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# Sustainability Self-Assessment and Business Model Design

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## Introduction

The business case of sustainability has been argued for by many authors (Willard, 2005; McNall et al., 2011). There is a large degree of consensus regarding the potential business impact of sustainability. However, most companies either are not acting or are falling short on execution. (MIT Sloan, 2009). Relatively few companies consider innovation for sustainability substantially rewarding. Suggested solution for this includes better access to frameworks for understanding sustainability and value creation and the business cases thereof (MIT Sloan, 2009). Furthermore, it is well-known that support for generation and selection of ideas and for formulating goals and strategies is especially essential to have during the early phases of the innovation process (Roozenburg & Eekels, 1995).

The usual absence of an operational definition of sustainability is still a major barrier to corporate strategic sustainable development (Holmberg & Robèrt, 2000). A sustainability definition that can guide assessment of the current situation and stimulate generation of ideas for upstream solutions and strategic guidelines that can aid prioritization of early smart actions are among the most promising leverage points. A framework including those features is being developed in an international consensus process since twenty years (see, e.g., Robèrt et al., 2012). Among other things, this framework for strategic sustainable development FSSD, clarifies the self-interest in sustainability work and thus supports more widespread and proactive sustainable innovation.

In this study, the FSSD is used as the main basis for a new tool to be used in early phases of the innovation process for self-assessment of an organization's current maturity and performance from an overall strategic sustainability point of view and for stimulating generation of ideas for business models design. We present a prototype version of such a tool and results from initial tests of this tool performed in four organizations. We study in particular whether the outlined tool is perceived by the organizations to be: (i) easy to comprehend, (ii) relevant, (iii) capable of differentiating the organizations in a comprehensive way, (iv) helpful for discovering insufficiencies that the organizations are not already aware of and (v)

helpful for generation and selection of ideas for upstream solutions, business model innovation and for formulation of goals, and strategies.

## Methods

The development of the sustainability self-assessment tool and related methodological process was guided by a framework for strategic sustainable development FSSD and its operational process backcasting from sustainability principles.

The framework for strategic sustainable development (FSSD), used as a foundation for this study and tool development, provides a generic support for backcasting planning in any field at any scale by applying generic sustainability principles as boundary conditions. The FSSD comprises five levels:

1. The system level – prompts a description of a topic with its nested subsystems in society in the biosphere,
2. The success level – prompts a description of success for the topic (e.g., success for a company in a future sustainable society), informed by basic sustainability principles,
3. The strategic level – includes guidelines for stepwise approaches towards compliance with the defined success,
4. The action level – prompts for concrete actions aligned with the strategic guidelines and put into a plan for compliance with the defined success, and
5. The tools level – links to concepts, methods and tools to support and monitor the transition between current situation and the defined success.

Backcasting implies that a successful outcome is imagined in the future, followed by the question: “what do we need to do today to reach that successful outcome?” The basic sustainability principles (level 2) have been derived from understanding first-order mechanisms through which society currently causes destruction of the socio-ecological system, and reads:

In a sustainable society, nature is not subject to systematically increasing

1. concentrations of substances extracted from the Earth’s crust (e.g. fossil carbon and metals);
2. concentrations of substances produced by society (e.g. CFC’s and NOX);
3. degradation by physical means (e.g. deforestation and overfishing)

and in that society

4. people are not subject to conditions that systematically undermine their capacity to meet their needs (e.g. through abuse of economic and political power).

The overarching guideline for organizations to support society’s compliance with these principles is to integrate them with the objectives of the organization, i.e., applying the sustainability principles as boundary conditions for redesign of visions and objectives, and then backcast from that integrated overarching goal. The FSSD implies a step-wise approach, ensuring that early steps are designed to serve as (i) flexible platforms for forthcoming steps that, taken together, are likely to bring the organization to the defined success by striking a good balance between (ii) direction and advancement speed with respect to the defined success and (iii) return on investment to sustain the transition process. A more comprehensive description of the FSSD is given by, e.g., Robèrt et al. (2012).

Other approaches, concepts, methods and tools that have been considered and used as a background for this study and tool development include, life cycle management (Ny et al., 2006), eco-design (McAloone et al., 2008), sustainable product development (Hallstedt, et al., 2008), green procurement (Bratt, C., 2011; LEAP-GPP, 2006; Williams et al., 2007; Procura+ ICLEI, 2007), sustainability driven goals, targets and indicators (França et al., 2009), business models (Osterwalder & Pigneur, 2010; Casadesus-Massanell & Ricard, 2010; Margreta, 2002; Teece 2009).

Testing and refinement of the proposed tool were supported by workshops and interviews with professionals from the following case study companies (Table 1.):

**Table 1: Case studies**

Organization	Activities	Persons involved	Time
Cascades Djupafors AB (Packaging industry)	2 workshops 1 interview/ assessment	Purchasing Managers Sustainability Experts – BTH	March / April 2010
Tetra Pak Technical Service AB (Food process and packaging industry)	2 workshops 1 interview/ assessment	Manager of Purchasing Department for Base Materials Sustainability Experts – BTH	March / April 2010
Scandic Hotels AB (Hotel chain)	2 workshops 1 interview/ assessment	Manager of Sustainable Business Sustainability Experts – BTH	March / April 2010
Affärsverken AB (Energy utility)	2 workshops 1 interview/ assessment	Managers, Project Directors from the company and municipality. Sustainability Experts – BTH	October / November 2010
Volvo Construction Equipment AB (Heavy machinery industry)	1 workshop	Managers, researchers and project directors Experts - BTH	October 2010

## Results

The proposed tool consists of three main parts:

### 1. The Sustainability Self-Assessment Matrix

A self-assessment matrix (Tables 3-7) displays the five levels of the FSSD with an added set of statements and in relation to each of those four maturity degrees (MD). The MDs represent the organization's maturity in addressing sustainability issues in a strategic way.

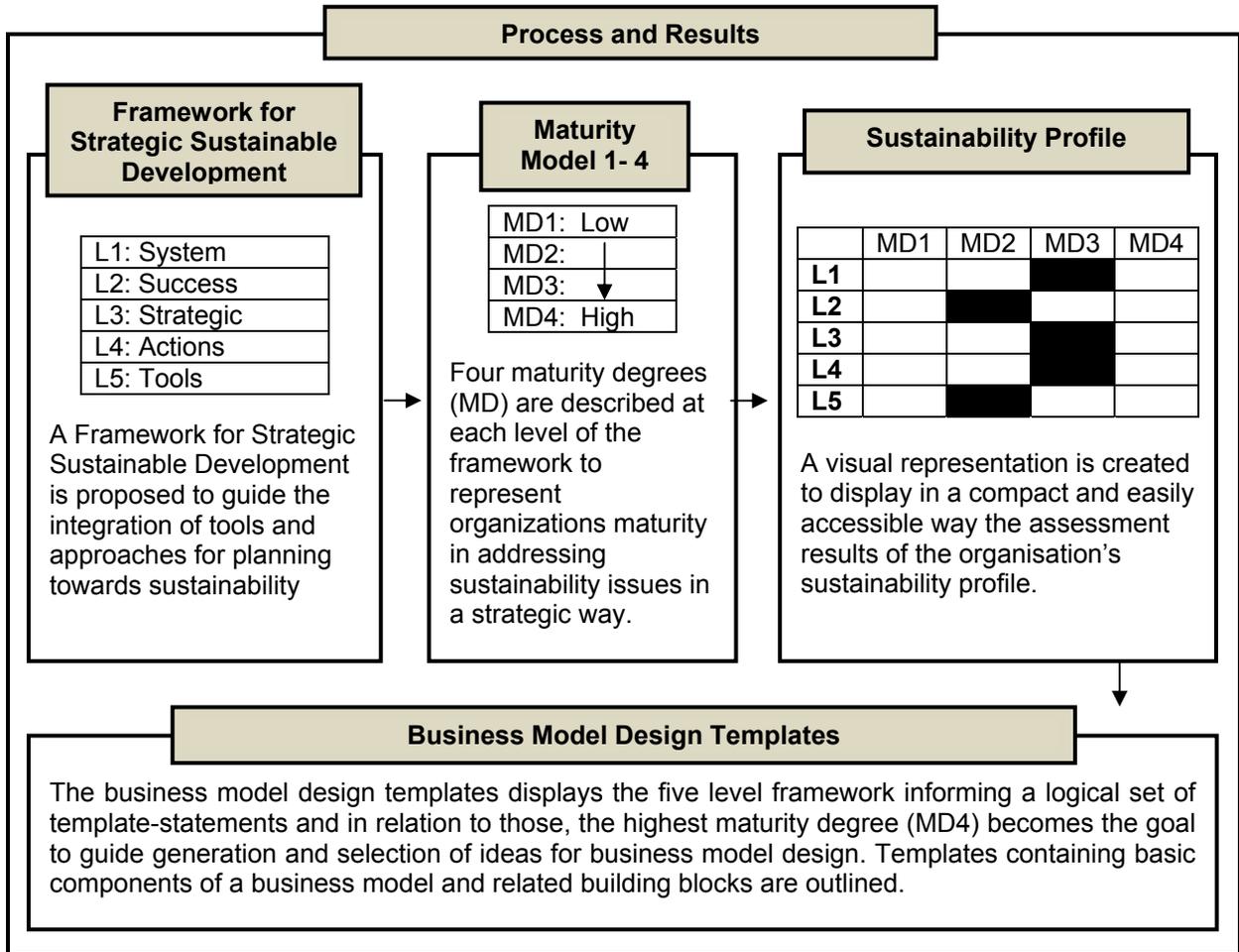
### 2. Sustainability Profile Visualization

A visual representation of the organization's sustainability profile is included in the tool to give a compact and easily accessible overview. As seen in Table 6 the case studies show a wide variety of sustainability profiles. For confidentiality reasons we do not indicate in this paper which profile that belongs to which organization.

### 3. Business Models Design Templates

The business model design templates (Tables 8-12) are similar to the Sustainability Self-Assessment Matrix but with MD4 given as the goal to guide generation and selection of ideas for business models design. Templates containing basic components of a business model and related building blocks were outlined.

**Figure 1: Process Overview and Results**



**Table 2: Sustainability Self-Assessment Matrix - Systems Level**

<b>1 - Systems</b>	<b>Statement</b>	<b>MD 1</b>	<b>MD 2</b>	<b>MD 3</b>	<b>MD 4</b>
Describes the overarching complex system of organizations, within society, within the biosphere in which we are planning and solving problems	The organization has a clear understanding of the operational design of its business models in relation to the environmental and social systems globally (including value chain and all kinds of stakeholders)	We have little or no understanding or engagement with environmental issues and with societal stakeholders in our value chain	We have conducted some environmental and social awareness activities, communication campaigns, and provided ad hoc reporting to some external stakeholders in our business system	We have an extensive repeated and systematic sustainability evaluations within the company in relation to our sustainable vision and have communicated and reported that to some stakeholders	We have an extensive repeated and systematic sustainability evaluation within the company in relation to our sustainable vision and goals, which occurs across the value chain and with other stakeholders – extended enterprise.
<b>Maturity Degree Assessment (E.g.)</b> 					

**Table 3: Sustainability Self-Assessment Matrix - Success Level**

<b>2 - Success</b>	<b>Statement</b>	<b>MD 1</b>	<b>MD 2</b>	<b>MD 3</b>	<b>MD 4</b>
Describes the organization's intrinsic goal, informed by sustainability principles applied as boundary conditions	The organization has a clear definition of success, including an operational definition of sustainability, and has an understanding of the business case of supporting society's transformation towards this definition	We have no formal corporate definition of sustainability; the term is used in different ways in different parts of the organization	We have no formal corporate definition of sustainability, however, the term is used in a reasonably uniform way throughout the organization	We have a formal corporate definition of sustainability that has been endorsed by senior management and disseminated repeatedly throughout the organization	We have a formal corporate definition of sustainability based on principles that are: necessary, sufficient, general, concrete and non-overlapping. We have full consensus and buy-in to this from senior management and across all the value chain including joint ventures
<b>Maturity Degree Assessment (E.g.)</b> 					

**Table 4: Sustainability Self-Assessment Matrix - Strategic Level**

<b>3 - Strategic</b>	<b>Statement</b>	<b>MD 1</b>	<b>MD 2</b>	<b>MD 3</b>	<b>MD 4</b>
Describes strategic guidelines that aid development towards success (including sustainability / success) in the system	The organization has adopted/ developed and built experience in using strategic guidelines that aid development towards sustainability	We do not yet have any strategic guidelines related to sustainable development and consequently no experience in using such guidelines	We have some strategic guidelines related to sustainable development and some experience in using those	We have a set of strategic sustainability guidelines, goals, and experience in applying those for all kinds of investments, repeatedly and systematically across the organization.	We have a full set of strategic sustainability guidelines and goals with extensive experience in applying those for all kinds of investments repeatedly and systematically throughout our operations across the value network
<b>Maturity Degree Assessment (E.g.)</b> 					

**Table 5: Sustainability Self-Assessment Matrix - Actions Level**

<b>4 - Actions</b>	<b>Statement</b>	<b>MD 1</b>	<b>MD 2</b>	<b>MD 3</b>	<b>MD 4</b>
Describes concrete actions and plans of actions (strategies) that are aligned with strategic guidelines to arrive at success in the system	The organization has well-documented concrete business plans that are fostered by strategic guidelines towards its goals and is systematically executing these plans together with relevant external stakeholders in its business system / value network	We have no plans and there have been no or few actions that are fostered by strategic guidelines and a definition of sustainability, and there has not been communication regarding sustainability with stakeholders outside the organization	We have some plans and there have been some actions that are fostered by strategic guidelines and a definition of sustainability, and also some cooperation regarding sustainability with some but not all relevant external stakeholder in our value network	We have plans and plenty of examples of major actions and investments that are fostered by strategic guidelines and a definition of sustainability, and extensive cooperation regarding sustainability with some but not all relevant external stakeholder in our value network	We have plans and there have been actions that involves investments in time and or money that are fully fostered by strategic guidelines and a definition of sustainability, and extensive methodical cooperation regarding sustainability with relevant external stakeholders in the business system
<b>Maturity Degree Assessment (E.g.)</b> 					

**Table 6: Sustainability Self-Assessment Matrix - Tools Level**

5 - Tools	Statement	MD 1	MD 2	MD 3	MD 4
<p>Describes various tools, methods and concepts used to assess, develop and monitor actions so that that they are aligned with strategic guidelines to arrive at success/ sustainability in the system</p>	<p>The organization makes use of, and informs tools, methods and concepts in a way that supports rational and cohesive use of the systematic approaches outlined in the previous four levels of the framework.</p>	<p>We have a general lack of tools, methods and concepts to support strategic sustainable development</p>	<p>We have some but not a complete set of tools, methods and concepts to support strategic sustainable development and we have a weak competence in how to utilize what we have</p>	<p>We have most of the necessary tools, methods and concepts to support strategic sustainable development, a strong competence in how to utilize each of the tools, methods and concepts and some competence in how to utilize these in a coordinated way</p>	<p>We have a complete set of tools, methods and concepts, all cohesively aligned with our overall business strategy to support strategic sustainable development</p>
<p><b>Maturity Degree Assessment (E.g.)</b> </p>					

**Table 7: Sustainability Profile Visualization**

FSSD ▼	MD1 [low]	MD2	MD3	MD4 [high]
Systems			■	
Success			■	
Strategic			■	
Actions			■	
Tools			■	

FSSD ▼	MD1 [low]	MD2	MD3	MD4 [high]
Systems			■	
Success		■		
Strategic			■	
Actions			■	
Tools		■		

FSSD ▼	MD1 [low]	MD2	MD3	MD4 [high]
Systems			■	
Success				■
Strategic		■		
Actions			■	
Tools				■

FSSD ▼	MD1 [low]	MD2	MD3	MD4 [high]
Systems		■		
Success	■			
Strategic		■		
Actions		■		
Tools		■		

**Table 8: Business Model Design Templates – Targets and Indicators / System level**

<b>1.System</b>	<b>Statement</b>	<b>Goal / MD4</b>	<b>Value network and business systems</b>	<b>Assessments, Targets and Indicators</b>
Describes the overarching complex system of organizations, within society, within the biosphere in which we are planning and solving problems	The organization has a clear understanding of the operational design of its business models in relation to the environmental and social systems globally (including value chain and all kinds of stakeholders)	We have an extensive repeated and systematic sustainability evaluation within the company in relation to our sustainable vision and goals, which occurs across the value chain and with other stakeholders (extended enterprise)	Value Creation and Proposition	Processes, activities, resources, assets
			Value Network and key Stakeholders	Suppliers, customers/ users, relationships, information and material flows
			Return on Investments / Value Capture	Revenue streams costs, life cycle costs, financial aspects and consumption patterns

**Table 9: Business Model Design Templates – Targets and Indicators / Success level**

<b>2.Success</b>	<b>Statement</b>	<b>Goal / MD4</b>	<b>Value network and business systems</b>	<b>Assessments, Targets and Indicators</b>
Describes the organization’s intrinsic goal, informed by sustainability principles applied as boundary conditions	The organization has a clear definition of success, including an operational definition of sustainability, and has an understanding of the business case of supporting society’s transformation towards this definition	We have a formal corporate definition of sustainability based on principles that are: necessary, sufficient, general, concrete and non-overlapping. We have full consensus and buy-in to this from senior management and across all the value chain including joint ventures	Value Creation and Proposition	Processes, activities, resources, assets
			Value Network and key Stakeholders	Suppliers, customers/ users, relationships, information and material flows
			Return on Investments / Value Capture	Revenue streams costs, life cycle costs, financial aspects and consumption patterns

**Table 10: Business Model Design Templates – Targets and Indicators / Strategic level**

<b>3.Strategic</b>	<b>Statement</b>	<b>Goal / MD4</b>	<b>Value network and business systems</b>	<b>Assessments, Targets and Indicators</b>
Describes strategic guidelines that aid development towards success (including sustainability / success in the system)	The organization has adopted/ developed and built experience in using strategic guidelines that aid development towards sustainability	We have a full set of strategic sustainability guidelines and goals with extensive experience in applying those for all kinds of investments repeatedly and systematically throughout our operations across the value network	Value Creation and Proposition	Processes, activities, resources, assets
			Value Network and key Stakeholders	Suppliers, customers/ users, relationships, information and material flows
			Return on Investments / Value Capture	Revenue streams costs, life cycle costs, financial aspects and consumption patterns

**Table 11: Business Model Design Templates – Targets and Indicators / Actions level**

<b>4.Actions</b>	<b>Statement</b>	<b>Goal / MD4</b>	<b>Value network and business systems</b>	<b>Assessments, Targets and Indicators</b>
Describes concrete actions and plans of actions (strategies) that are aligned with strategic guidelines to arrive at success in the system	The organization has well-documented concrete business plans that are fostered by strategic guidelines towards its goals and is systematically executing these plans together with relevant external stakeholders in its business system / value network	We have plans and there have been actions that involves investments in time and or money that are fully fostered by strategic guidelines and a definition of sustainability, and extensive methodical cooperation regarding sustainability with relevant external stakeholders in the business system	Value Creation and Proposition	Processes, activities, resources, assets
			Value Network and key Stakeholders	Suppliers, customers/ users, relationships, information and material flows
			Return on Investments / Value Capture	Revenue streams costs, life cycle costs, financial aspects and consumption patterns

**Table 12: Business Model Design Templates – Targets and Indicators / Tools level**

5.Tools	Statement	Goal / MD4	Value network and business systems	Assessments, Targets and Indicators
Describes various tools, methods and concepts used to assess, develop and monitor actions so that that they are aligned with strategic guidelines to arrive at success/ sustainability in the system	The organization makes use of, and informs tools, methods and concepts in a way that supports rational and cohesive use of the systematic approaches outlined in the previous four levels of the framework	We have a complete set of tools, methods and concepts, all cohesively aligned with our overall business strategy to support strategic sustainable development	Value Creation and Proposition	Processes, activities, resources, assets
			Value Network and key Stakeholders	Suppliers, customers/ users, relationships, information and material flows
			Return on Investments / Value Capture	Revenue streams costs, life cycle costs, financial aspects and consumption patterns

## Concluding Remarks

The tool presented in this paper comprises a Sustainability Self-Assessment Matrix that aim to aid clarification of the assessed organization’s maturity in addressing sustainability issues in a strategic way, a Sustainability Profile Visualization that aim to aid a compact and easily accessible overview of the result of the above assessment and a set of Business Model Design Templates that aim to guide generation and selection of ideas for business models design.

From the testing in the case companies we conclude that the self-assessment matrix provided great opportunity for dialogue and clearly exposed opportunities and challenges that exist between the lower and the higher sustainability maturity degrees of the matrix. It also provided guidance for idea generation for how to move towards higher levels of maturity. By using the matrix, the companies were sensitized to an approach that is more strategic and less reductionist. The profile visualization was highly appreciated by the case companies as a way of summarizing the assessment results.

The business model design templates extended the maturity matrix deeper into the value chain and linked to typical business model terminology and at this stage of work with the case companies a range of creativity supporting tools for idea generation were introduced. In one case study, modelling of future energy systems in housing and buildings that followed the creativity exercises triggered insights for prototyping innovative business models, which included aspects such as resources availability, likely future customer preferences and user’s behaviours and lifestyles.

In summary, the case studies provided initial support for the desired ability of the presented tool; to assess and visualize the maturity of an organization from a strategic sustainability perspective and to trigger systematic cooperation for generation and selection of ideas for upstream solutions, new business models and strategic goals and indicators during early phases of the innovation process. Resources for training trainers in using aligned operational support methods and tools were identified as one of the main remaining needs. In future work we will develop such resources and also investigate the possibility of including into the tool itself more user guidance, case study examples and creativity supporting tools.

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## Authors Resume

### França, César Levy

César Levy França is a PhD student of the Sustainability-Driven Innovation Group from Blekinge Institute of Technology BTH, Karlskrona Sweden. His research is focused on integration of sustainability-driven strategies and business models design. He holds a master's degree in strategic leadership towards sustainability from Blekinge Institute of Technology. Parallel to his studies he leads the creativity for product and service development course at BTH, and coordinates a cooperation agreement for student and staff exchange between Blekinge Institute of Technology and Federal University of Amazonas, Brazil. He was co-founder and director in Brazil for the international sustainability organization The Natural Step.

### Broman, Göran

Prof. Broman is Director of the Sustainability-Driven Innovation Group and Director of the Center for Sustainable Product-Service System Innovation at Blekinge Institute of Technology, Karlskrona, Sweden. He holds a doctoral degree in mechanical engineering from Lund University. Parallel to his engineering education he has undertaken extensive studies in ecology, economy, resource theory, leadership and other subjects relevant to his passion in sustainability and he has been instrumental in the development of a framework for strategic sustainable development. Prof. Broman is active in a broad range of areas, reaching from *strategic sustainable development* over *product-service system innovation* to *engineering and simulation-driven design*. Prof. Broman leads a team that develops methodology and combines competences within these areas with the uniting purpose of creating capacity in business and society for *sustainable innovation*. The work is performed in an action research mode with business and societal partners.

### Robért, Karl-Henrik

Dr. Robért received his M.D. in 1975, his Ph.D. in 1979 and in 1981 he became an Associate Professor of Internal Medicine. In 1984, he won the Swedish Hematological Association Research Award. From 1985-1993 he headed the Division of Clinical Hematology and Oncology at the Department of Medicine at the Huddinge Hospital. He founded, and was the Editor of, *Reviews in Oncology* from 1987 to 1993. While heading a research laboratory at the Karolinska Institute Dr. Robért authored more than ninety scientific publications concerning leukemia, lymphoma, lung cancer and their clinical. He educated 4 young scientists in medicine who published their doctoral dissertations at his research laboratory.

Since 1988, he has been leading a scientific consensus process that arrived at the development of a unique way of systematic planning towards sustainability – 'backcasting from first order principles for social and ecological sustainability'. To facilitate the consensus process between science and decision making, Dr Robért founded an NGO, The Natural Step, currently with offices in 12 countries distributed over all continents, advising business and cities to implement the front line science for concrete decision making.

After a career as adjunct professor in Physical Resource theory at the Institution for Physics at the Chalmers University of Technology in Gothenburg, and later guest professor of Sustainable Product Development at BTH, Karlskrona, he is now Professor of Strategic Sustainable Development at BTH. He has written many books and scientific publications on the linkage between ecology, economy and technology, he has supervised, and been co-supervisor, of many PhD doctorates in sustainable development and he has co-founded a Masters program for Strategic Leadership towards Sustainability, MSLS, now on its eight year at BTH.

**Trygg, Louise**

Louise Trygg is Associate Professor and Director of Studies at the division of Energy System at Linköping University. She is leading a research group within the interdisciplinary national research programme Energy Systems. She was previously Business Area Manager at the energy utility E.ON. She has a master of science in mechanical engineering and a doctoral degree in Energy Systems. Her research area concerns regional and municipal energy systems and by using optimization models she has studied how the combined energy system of energy user and energy supplier can shift in the direction of cost- and resource effectiveness. She has also analyzed a great number of small- and middle sized industries in different Swedish municipalities and found measures that strongly can reduced the industries' use of energy. Her work is performed in close cooperation with actors like industries and energy utilities.