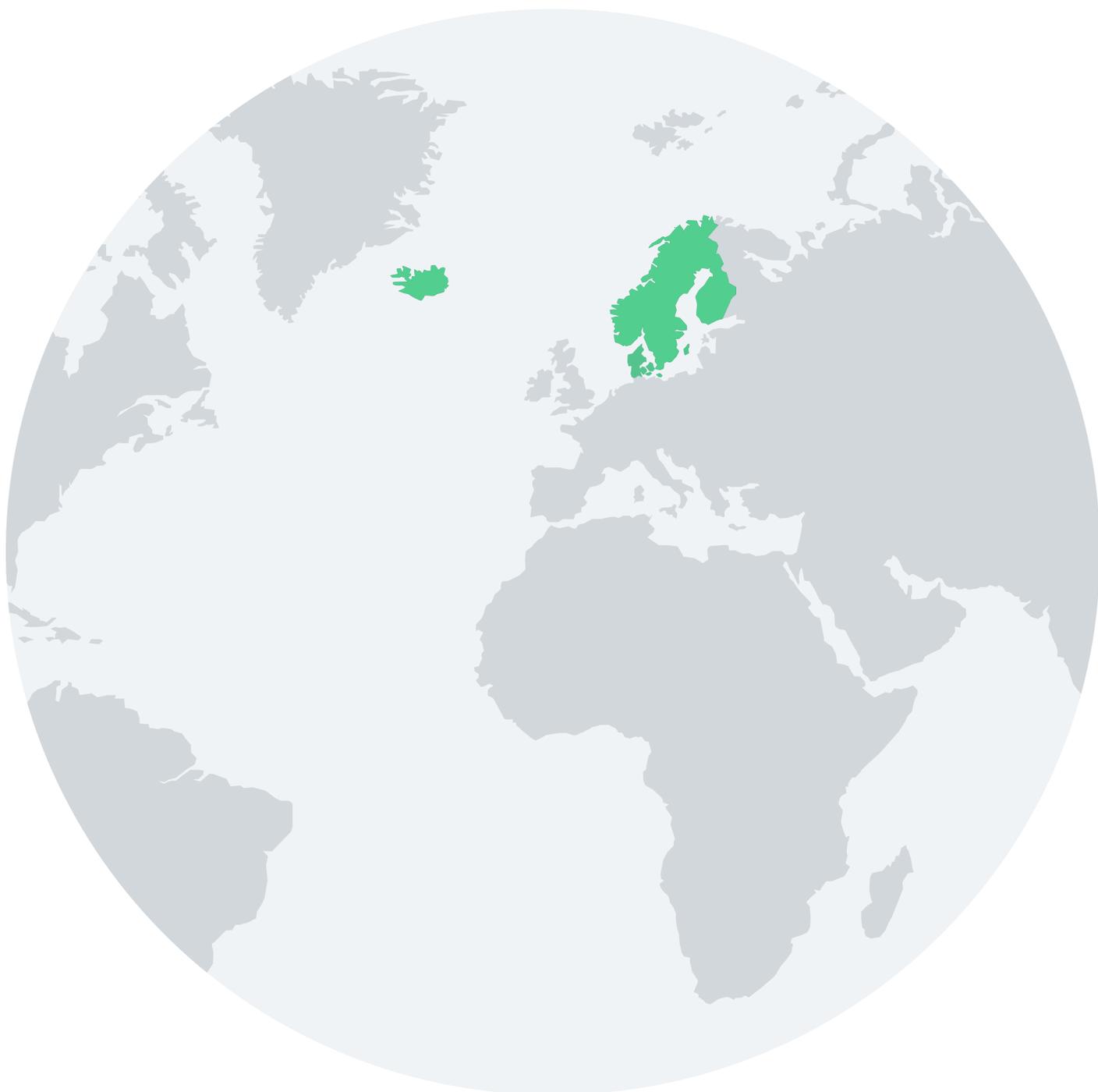


# Green paper

October 2010

# Green business models in the Nordic Region

A key to promote sustainable growth





# Preface

The Nordic countries are among the world's best and wealthiest communities. And they should continue to be so. But our societies are - like the rest of Europe - faced with a number of challenges. Challenges that must be tackled in order to preserve our future welfare and prosperity.

The global economic crisis has intensified these challenges. No country or industry has escaped. One of the consequences of the crisis has been the loss of jobs in the private sector. These lost jobs must be replaced by new, productive jobs in future growth sectors and in sustainable industries.

Changing the current fossil based economy into a sustainable green economy is not a simple task, nor something we will achieve overnight. It will take hard work. It will affect the way we live and the way we do business.

Ten years ago the internet and mobile communication technologies revolutionized the way we communicate and exchange knowledge. Now we must focus on the way we utilize physical resources and optimize material flows in industrial production systems. In order to make the transition into a truly green economy we will have to change the way we do business and the way in which we design the regulatory framework.

It is important, that we do this in a way that does not reduce the competitiveness of Nordic enterprises, but strengthens their ability to compete on the global markets - that will have both economic and environmental benefits.

The Nordic countries and companies are generally among the first to adapt to new opportunities. Some companies in the Nordic countries are already developing green business models. Their experiences hold a substantial learning potential for both companies and policymakers.

This Green Paper explores various types of green business models. It focuses on their economical and environmental potentials, opportunities and challenges in order to develop recommendations and initiatives that will support the dissemination of these models across the Nordic region.

Work on this green paper has been financed by the Danish Presidency for the Nordic Council of Ministers, the Nordic Council of Ministers, the Danish Enterprise and Construction Authority and the Danish Ministry for Economic and Business Affairs. I am convinced that the study will be useful as a first step towards enhanced governmental and business focus on the economic and environmental benefits that arise from the use and development of new green business models.



Brian Mikkelsen

Minister for Economic and Business Affairs



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The Green Paper has been prepared by FORA, the Danish Enterprise and Construction Authority's division for research and analysis with the consultancy COWI as subcontractor.

# 1. Executive Summary:

## Creating sustainable development and new jobs

The Nordic countries are, like so many other countries, faced with a multiple set of challenges. The current economic crisis has severely impacted the economy in the Nordic countries and the Nordic companies. There is an increasing need for a more sustainable and low-carbon development, and a need for increasing innovation and improving competitiveness. These are some of the common challenges across the Nordic countries.

The concept of green business models is a way of facing these challenges. Green business models involve the creation of new types of jobs, lower environmental impacts, and they are very promising platforms for innovation. Green business models come in various sizes and shapes; however, a common denominator is that the companies applying green business models can change their core business strategy from selling products to selling service systems which includes their products. These business models are known as Product Service Systems.

Product Service Systems cover business models that are developed to provide the customer with a mix of products and services that are tailored for the customer's needs. Under such business models the provider often retains ownership of the physical product. A sales contract can often include maintenance, repair and end-of-life consideration into the service of the product. This alters the relationship between the supplier and the customer and the encouragement for the suppliers to innovate and develop both product and service.

This *Green Paper* has explored various types of green business models that all to a certain extent build on the service system approach in order to cast light on the economical and environmental potentials of these models across the Nordic region. The key findings are that green business models have the potential to:

- generate solid business cases and jobs on a market that is expected to grow
- lead to significant lower environmental impacts
- serve as a catalyst for innovation in search for delivering the same or better services with the use of less resources
- support company branding - often both for the supplier and the customer
- increase motivation amongst workers, which again is a key component in attracting and sustaining the brightest minds now and in the future
- become an international stronghold in the Nordic region

The majority of companies and experts interviewed for the Green Paper pin-point that in their view the economic and environmental potential for their specific business model or area of interest in the Nordic countries is significant.

Green business models are, however, not very known and well disseminated in the Nordic countries. Quantitative analyses on the performance and effects of the green business models are scarce in a Nordic context, and a critical level of knowledge for this Green

Paper was only achieved through an aggregated Nordic assessment. For that reason, the companies and experts call on the politicians to support the green business approach in order to fast track their dissemination in the Nordic economy. The recommendations gathered from the companies and experts fall into six major categories spanning the different green business models that this Green Paper has explored. The following key recommendations can be highlighted:

- Increase awareness through case stories, documentation of effects, demonstration projects, guides etc. about green business models and the advantages they generate. The target group should be both the public and private business community
- Support the sales position of the suppliers of green business models with tools and arguments that clarify the potential directed at the relevant levels and access points in the customers organisation including high level management
- Promote the potential benefits and business opportunities of green business models for private and public financial institutions
- Promote the use of green business models in public procurement and regulation
- Develop common Nordic standard contract paradigms for green business models

In conclusion, the promotion and support of green business models constitute a very interesting and promising opportunity for the Nordic countries to stimulate growth and generate new jobs, while supporting the transition towards a more sustainable society. The Nordic Councils of Ministers can further support such a development and activate business as the main driver in this development.

*It is recommended that the Nordic Council of Ministers continues to focus on this area and to support the dissemination of good practice on green business models (including better documentation of effects) to public authorities, institutions and private companies. It is suggested that the future work is rooted in a Nordic High Level Policy Group, and that NICE (Nordic Innovation Centre) plays a central role in the implementation of new initiatives in the area.*

## 2. Green business models in the Nordic region

The objective of this Green Paper is to explore the economical and environmental potential of green business models in the Nordic Region, and to understand the opportunities and challenges facing the companies involved. It is designed to help policymakers to identify ways to support a green growth economy in a coordinated and connected way in the Nordic countries, by disseminating green business models to a larger extent. Both the EU commission<sup>1</sup> and the US Environmental Protection Agency<sup>2</sup> have recently undertaken respective desk studies on green business models. However, this Green Paper marks the first project which focuses on the Nordic region.

<sup>1</sup> [http://ec.europa.eu/environment/enveco/innovation\\_technology/pdf/nbm\\_report.pdf](http://ec.europa.eu/environment/enveco/innovation_technology/pdf/nbm_report.pdf)

<sup>2</sup> <http://www.epa.gov/osw/partnerships/stewardship/docs/green-service.pdf>

The Green Paper provides a first step in identifying and describing green business models in the Nordic region and in exploring their economic and environmental potential. The Green Paper points to the initiatives which companies and experts find are needed to overcome the barriers and to acknowledge and reinforce the drivers, so that green business models may be more widely used in the Nordic countries. However, it should be underlined that the design and implementation of policies to foster and strengthen the determinants of green business models lies outside the scope of this Green Paper. This should be followed up by a joint Nordic effort along with cross-border cooperation with institutions, organisations and companies already working in this area to harvest the full potential.

Generally, green business models compared to 'classical' green businesses (e.g. cleantech) are characterised by focusing on the potential in the supplier's *management of the customer's production, innovative business strategies and business to business relations* reducing either energy consumption, resource use or waste, thus creating economic and environmental benefits for both supplier and customer – a win-win situation. The definition used in this project is given in Box 2.1.

### Box 2.1 Definition of green business models

“Green business models are business models which support the development of products and services (systems) with environmental benefits, reduce resource use/waste and which are economic viable. These business models have a lower environmental impact than traditional business models”

Classical green businesses (e.g. cleantech) are usually focused on a green product, which is more energy efficient, produced with less material and energy use etc., while a company making use of 'green business models' focuses on the management of (or some of) the customer's production and is paid according to the result in the customer's production (i.e. a provider of refrigerators is paid for the service of 3 degrees in the refrigerators instead of being paid for the product, i.e. the refrigerator itself). This gives the producer, who also owns the product, the incentives to design the products to perform optimally in terms of the products life-cycle costs (i.e. energy, maintenance, waste disposal etc.).

## Different categories of green business models

Green business models are already emerging in various ways on different markets in the Nordic countries. Based on existing literature and consultation of experts the following five models were selected for closer inspection in this Green Paper.

- The first model *Functional Sales* is a generic model which holds common characteristics of all green business models. In functional sales the provider offers the customer to pay for the functionality or result of the product instead of buying the product itself. One example is the Swedish company Volvo Aero, which produces airplane engines and offers their customers to buy the power of the airplane engines ('power by the hour') instead of buying the engine itself. The structure of the business model gives the provider the incentives to optimize and maintain the product (the engines in the Volvo case) to ensure life-cycle cost effectiveness which will reduce the environmental impact (less fuel consumption).
- The most widely disseminated green business model is *Energy Saving Companies* (ESCOs). The provider of ESCO energy optimizes companies and public buildings and in return gets paid by part of the savings achieved. The customer does not have to pay up front. Most examples stems from the public sector (buildings). One example from the private sector is the Danish company Danfoss Solutions which guarantees energy savings for industrial companies and is paid according to the energy performance of their installations. The customers are compensated if savings are less than guaranteed.
- Another green business model is emerging in the chemical services industry known as *Chemical Management Services* (CMS). Here, the CMS Company engages in a strategic, long-term contract to supply and manage the customer's chemicals and related services. The providers of CMS are typically remunerated in some form of the customers output (e.g. painted car doors). This gives the provider the incentives to reduce the input products (e.g. paint for car doors). One example is AGA Gas in Sweden that reduces their customers' chemical procurement costs by reducing their use of chemical products and getting better procurement deals from suppliers.
- In the construction industry the green business model *Design, Build, Finance and Operate* (DBFO) has emerged. In this business model long term contracts involving the construction, maintenance and operation phase (typically 20-30 years) of the project (a building) give incentives to improving the quality of the construction project so that the life-cycle costs are lowered. One example is the Finish Kaivomestari senior school, swimming hall and sports centre realised through a partnership between the project company Arandur Oy and the City of Espoo.
- A fifth green business model is the *Sharing* business model. Here, the basic idea is that instead of private ownership, the product is shared among a number of users whenever the individual users need access to the product. The economic benefits of this model are less evident than in the other business models, but the sharing of products may pave the way for new products to the market. One example is the Norwegian car-sharing company Move About.

## Methodology

Since green business models in general is a relatively new policy and research area in the Nordic countries, an initial desk study was carried out to identify different kinds of green business models. From available reports and literature on the field the five green business models were chosen for further investigation. The results of this investigation formed the basis for a qualifying discussion in a Nordic working group of the project as well as with public authorities and central business organisations in the Nordic countries.

<sup>3</sup> Snowballing is a method of expanding a sample by asking one informant to recommend others for interviewing.

A minor snowball analysis<sup>3</sup> was then carried out in the Nordic countries to find the companies that use these green business models. This was not an easy task, as the green business models are not very known nor well disseminated among the Nordic countries. However, the process led to the selection of 25 case companies along with 5 experts which were interviewed about the economical and environmental benefits, barriers and drivers of 'their' green business model, their estimations of the market potential in the Nordic region as well as which initiatives that would support the dissemination of the business models. For each case, one company representative was interviewed. All in all, 30 interviews were conducted.

The results from the interviews were discussed and qualified by 50 Nordic and international representatives from companies, industry organisations, experts and authorities at a workshop held in Copenhagen on the 3rd of September 2010. The workshop was organised around five parallel sessions on each of the green business models in focus; *Functional Sales*, *Energy Saving Companies (ESCO)*, *Chemical Management Services (CMS)*, *Design, Build, Finance and Operate (DBFO)* and *Sharing*.

The findings of this Green Paper are based on the responses and estimations of the interviewed case representatives and experts as well as on the information generated on the workshop.

It must be noted, that the Green Paper focuses on the potential economic and environmental benefits from applying green business models. It has not been the scope of this paper to analyse the potential disadvantages for companies in using these models. With regard to the economic potential it must also be noted that the application of a green business model can pave the way for new markets for the company - although not necessarily. The company using a green business model might just be approaching an existing market but in a new and environment friendly way.

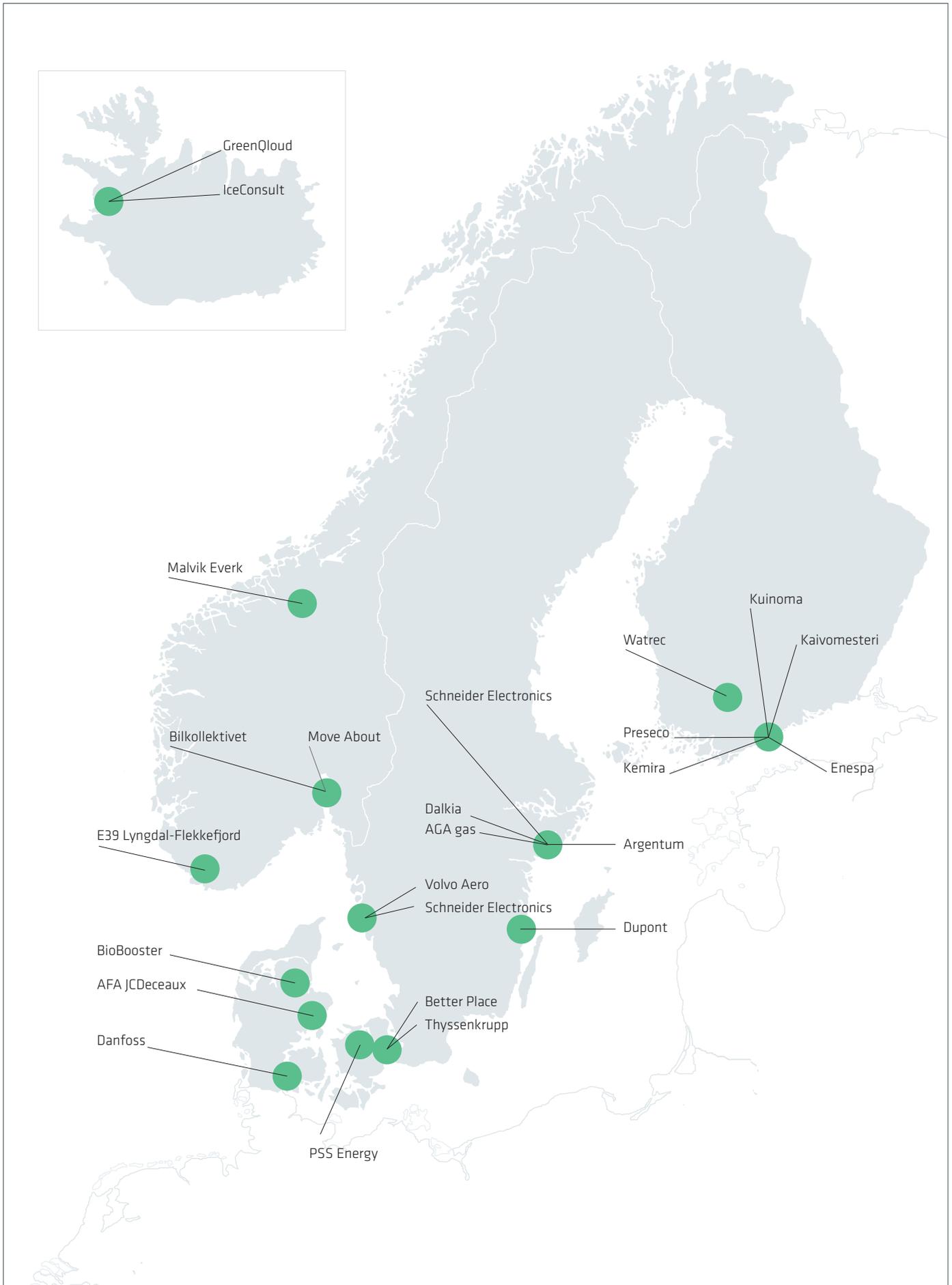
In Box 2.2 the Nordic experts interviewed on the specific business models are listed.

**Box 2.2** Nordic experts interviewed in the Green Paper

Model	Expert
Functional sales	Mattias Lindahl, Assistant Professor, Linköping University, Sweden
ESCO	Magnus Enell, Adjunct Professor, IIIIEE, Lund University, Sweden
CMS	Markku Anttonen, Project Manager, Aalto University School of Economics, Finland
DBFO	Ole Helby Petersen, Research Assistant, AKF, Denmark
Sharing	Oksana Mont, Assistant Professor at IIIIEE, Lund University, Sweden

Figure 2.1 illustrates a map with all the case companies interviewed about their green business model and its dissemination in the Nordic region. All case companies and their business are shortly described in the subsequent Table 2.1

**Figure 2.1** The dissemination of case companies in the Nordic region.



**Table 2.1** Case companies interviewed in the Green Paper

Functional Sales	Volvo Aero	The Swedish company Volvo Aero amongst other things develops and produces components for aircraft and gas turbine engines.
	Better Place Denmark	Better Place Denmark is a network and service provider of electric vehicles (EV) as an environment-friendly alternative to traditional cars.
Energy Saving Companies (ESCOs)	Schneider Electric, Buildings	The Swedish company Schneider Electric, Buildings (SE,B) has been working with energy performance contracting (EPC) in Sweden since 2002
	Region-Fastigheter	Schneider Electric has provided energy performance contracting (EPC) to RegionFastigheter – the office of property services for public hospitals in southern Sweden.
	Danfoss Solutions	Danfoss Solutions in Denmark makes ESCO projects for industrial companies primarily in the food and beverage markets
	Dalkia Sweden	Dalkia Sweden is offering ESCO solutions to real estate owners
	ThyssenKrupp Rulletrapper	ThyssenKrupp Rulletrapper is a global company with a Danish division specialized in installation, service and maintenance of moving platforms such as moving staircases and sidewalks.
	Göteborg Energi	Göteborg Energi in Sweden has been involved in an ESCO solution to Bodycoat Värmebehandling AB to monitor and regulate the ventilation system.
	Enespa	Enespa is a Finnish broker ESCO company which is subcontracting engineering, installation and equipment for other parties
Design, Build, Finance and Operate	E39/Lyngdal-Flekkefjord	E39 Lyngdal-Flekkefjord is a Norwegian DBFO road project. It is one of three pilot projects that were implemented as a part of the Norwegian Transportation Plan for the period 2002-2011.
	Kaivomestari	The Kaivomestari senior secondary school, swimming hall and sports centre is the first design, build, finance and operate (DBFO) project in the real estate sector in Finland.
	Watrec	Watrec is a Finnish company specialized in environmental engineering and science. The company offers plants and processes for organic waste and wastewater treatment. Its solutions enable production of green renewable energy from organic waste materials and wastewater.
	AFA JCDecaux	AFA JCDecaux in Denmark is specialized in outdoor advertising on billboards, in airports and on street furniture like bus shelters, public toilets, map and information panels, garbage cans, city bikes, bus and train stops etc.
Chemical Management Systems (CMS)	Kemira Operon	Kemira Operon is a Finnish division of the global chemicals company Kemira. The focus of the company is to serve customers in water-intensive industries.
	Argentum	Argentum is a Swedish consultancy agency operating within industrial processes, environment and chemicals.
	AGA Gas	AGA Gas in Sweden help their customers to continuously introduce safer chemicals at lower consumption levels and with less hazardous waste disposal.
Sharing	Bilkollektivet	Bilkollektivet is the largest car-sharing organization in Norway. It is a non-profit cooperative organisation initiated in 1995.
	Move About	Move About is a Norwegian mobility service company renting out electric cars.
	Kuinoma	Kuinoma is a Finnish company that facilitates a web-based portal for rental and free lending of items.
	GreenQloud	The Icelandic company GreenQloud is specialized in public cloud computing services for companies and individuals based on the excessive green energy available on Iceland
Other Green Product Service Systems	Malvik Everk	Malvik Everk is a green PSS and one of few distribution system operators (DSO) in Norway that have a full roll out of automatic meter reading (AMR) to household customers.
	PSS Energy	PSS Energy in Denmark is an entrepreneurial company which is offering their customers energy savings by reducing excessive supply of voltage in the customer's electric network.
	Preseco	Preseco is a Finnish company that designs, constructs and operates waste refining plants.
	BioBooster	BioBooster in Denmark provides flexible solutions for wastewater treatment by containers which have specific functionalities.
	ICEconsult	ICEconsult is an Icelandic company, which develops comprehensive software solutions for facility management.

## **Outline of the Green Paper**

In the remains of the Green Paper, each of the selected five green business models is described in more detail and illustrated by some of the company cases. In addition, the following other green business models are described; Cradle to Cradle, Sustainable Supply Chain Management and Industrial Symbiosis.

Background material on all company cases and expert interviews can be downloaded from the websites of the Nordic Council of Ministers ([www.norden.org](http://www.norden.org)), The Danish Enterprise and Construction Authority ([www.ebst.dk](http://www.ebst.dk)) and FORA ([www.foranet.dk](http://www.foranet.dk)).

## 3. Different green business models

This chapter describes and outlines the key characteristics, economic and environmental potential, barriers and drivers and recommendations of the selected five green business models across the Nordic region; Functional sales, ESCO, CMS, DBFO and Sharing business models. The first model is a generic model, where the principle of Functional sales is described. This principle is a common characteristic for all green business models. The following three models each have their own specific characteristics. The fifth model 'Sharing' is described in the same way as the other models, although the economic potential is less evident for this model compared to the others. For matter of completeness the last section of this chapter highlights other kinds of green business models; Cradle to cradle, Sustainable Supply Chain Management, and Industrial Symbiosis.

### 3.1 Functional sales

#### The model

Functional sales is a generic model with common characteristics for all green business model. In general for all models there is a focus on providing the function and benefits of the product instead of the physical product as such. Instead of paying for the product per se a part of the transaction is payment for the function of the product.<sup>4</sup>

<sup>4</sup> Mont O., (2004): Product-service systems: panacea or myth? PhD thesis, IIIIEE, Lund University, Sweden

<sup>5</sup> Lindahl, M. (2006): "Hur skapa mervärde med integrerade product- och tjänsterbjudande", Uppfinnaren & Konstruktören, 5/2006

<sup>6</sup> Ölundh, G. and S.Ritzén (2001): Functional Sales as a further approach to Environmental Product Development - case study. Proceedings of EcoDesign 2001, Second International Symposium on Environmentally Conscious Design and Inverse Manufacturing, Tokyo, Japan

<sup>7</sup> Mont O., (2004): Product-service systems: panacea or myth? PhD thesis, IIIIEE, Lund University, Sweden

Functional sales models are developed to provide the customer with a mix of products and services that meet the customer's needs. The products and services are typically developed in a parallel process, where service and product are mutually adapted to work well together.<sup>5</sup> In functional sales models the ownership of the physical product often stays with the provider, and maintenance, repair and end-of-life consideration can be included in the offer.<sup>6</sup>

A key characteristic of functional sales is that the service provider takes over the control of the use-phase of the product. By improving the control of the use-phase of the product the producer gets an incentive to improve the output yield and to extend the life-span of the product by making the product more durable, reducing the need for spare parts, making it more energy efficient, improve maintenance of the product etc. Another important aspect of many functional sales models is that they are designed for remanufacturing and reuse of the product.

In traditional sales there is an inherent conflict between the producer/provider and the customer: the producer seeks high prices, whereas the consumer seeks to reduce costs. Further, producers aim at selling additional services, more consumables products and spare parts. The discrepancy of interest may lead to situations, where the producer offer more advanced products than what the customer needs. In functional sales models the interests between customer and producer become more aligned.<sup>7</sup>

The case company Volvo Aero is a show case example of functional sales. Volvo Aero sells aircraft engines and engine maintenance. The company provides its customer with a business model where it sells flying hours and not just engines - this is popularly known

as 'power per hour'. In these types of contracts Volvo Aero takes over the control of the performance of the engine. By improving the maintenance of the engines, the company has been successful in reducing fuel consumption of the operation of its aircraft engines, cf. Box 3.1.1.

#### **Box 3.1.1** Case study: Volvo Aero

Swedish Volvo Aero, a subsidiary of AB Volvo, develops and produces components for aircraft and gas turbine engines and sells engine maintenance. The company offers traditional service but it also offers a 'flight hour agreement' basically selling flight hours to clients.

According to the flight hour agreement Volvo Aero is responsible for the performance of the engine. This is reflected in the performance - the engines maintained according to this agreement perform 1½-2 pct. better than the Engine Maintenance Manual stipulates and the fuel consumption is 1½ - 2 pct. lower than the consumption of engines maintained in a traditional manner.

Over the last three years the maintenance service based on the business model of flight hour agreement has increased from 30 to 50 pct. of the company's maintenance business. It is often smaller air craft carriers which make use of this model.

Functional sales have been used within a range of different product groups. The Swedish company ITT Flygt has experiences with selling pump capacity - in contrast to "just" selling the submersible pump, and the Swedish company Swepac provides operational leasing with maintenance contracts of soil compactors - instead of selling the soil compactors.<sup>8</sup> Operational leasing is also provided by Better Place Denmark. Better Place are in the process of implementing a business model for electric vehicles in Denmark, where the company provides the customer with the energy needed for propelling the electric vehicle, cf. Box 3.1.2.

<sup>8</sup> Ölundh, G and S. Ritzén (2003): How do Functional Sales Affect product Development and Environmental Performance, Proceeding of ICED '03, International Conference on Engineering Design, Stockholm

#### **Box 3.1.2** Case study: Better Place Denmark A/S

Better Place Denmark A/S is a network and service provider of electric vehicles. Better Place is expecting to introduce electric cars on the Danish market in 2011. The company is now developing and deploying a network of charge spots and battery switch stations, in-car services and software for electric cars.

The future customers will buy or lease the electric car and subscribe to the services of Better Place including access to charge spots, battery switching stations and a swappable battery.

Using electricity from renewable energy like windmills means almost zero emissions of CO<sub>2</sub>. Even in the worst case possible where no wind is blowing and electricity production is based on fossils, electric vehicles are still 3-4 times more energy efficient than traditional cars.

## Market potential

<sup>9</sup> Ölundh, G and S. Ritzén (2003): How do Functional Sales Affect product Development and Environmental Performance?, Proceeding of ICED '03, International Conference on Engineering Design, Stockholm

Developing and offering functional sales entitle companies to meet customer demand, to increase market shares by differentiating products through adding services, and to get new technologies on the market.<sup>9</sup> The use of functional sales models in the Nordic countries is growing, but the use is still not very widespread. It is still unusual for the original equipment manufacturer to be directly involved in functional sales and to design products to be remanufactured in a functional sales context.

According to the expert interviewed on functional sales, there is a potential for the dissemination of the functional sales models in the Nordic countries and for integrating functional sales business models within a number of product groups and services. The expert holds that there is a major potential for functional sales within the construction industry. Presently, construction companies focus on building houses at the lowest possible costs. The largest costs of buildings are related to the use-phase of the building. These costs include costs for energy consumption, refurbishment, cleaning etc. If the provider of the house is also responsible for the house in the use-phase there would be a strong incentive for increasing the material and energy efficiency of the use-phase. The DBFO business model, which is presented in section 3.4, is an example of a similar set-up where the company that builds the building is also responsible for operation and maintenance - often over several decades. It is also noted by the expert that besides for buildings there is a great potential for functional sales within other kinds of infrastructure like roads and in the transportation sector.

Volvo Aero also sees a potential for using business models similar to their own in other industries where operation, time and operational environment can be tracked and controlled. Business models similar to the one used by Volvo Aero could be used for transmissions provided by subcontractors to windmill producers. Functional sales models are, however, not suitable for all types of products. The expert on functional sales holds that there is a need to identify in which sectors and for which product groups functional sales is most suitable.

Producer liability for reuse and recycling of products has become a focus area for national and EU policies, and it is an area where more focus is likely to come in the future. This gives producers incentives to design products that are reusable and that may be remanufactured.

## Economic and environmental benefits

New business opportunities emerge as the company changes its focus from selling volume of products, maintenance services and spare parts to meeting the customer's needs by selling the function of the product. Functional sales also improve the companies' competitiveness. The competitiveness is improved by reducing the consumption of material resources and energy and more efficient working routines throughout the products use-phase. Further, products that are designed to be remanufactured may contribute to savings as the need for virgin resources to manufacture new products is reduced. Functional sales also contribute to improve the relationship between provider and customer - customer loyalty increases as the relation becomes closer and lasts longer.<sup>10</sup>

<sup>10</sup> Ölundh, G. and S.Ritzén (2002): Funktionsförsäljning och produkters miljöaspekter - en studie i tre svenska tillverkningsföretag, Naturvårdsverket, Rapport 5234, July 2002

For the customer the advantage of functional sales is the payment per use/function of the product. Thereby, the cost of the use-phase of the product becomes transparent - the customer does not have to bear the investment costs and the operation costs are known in advance.

<sup>11</sup> Larsson, H (2009): Kartläggning av miljö- och kostnadsfördelar som ett Integrerat Produkt- och TjänsteErbjudande av rent golv ger jämfört med traditionell försäljning av golvvård, Institutionen för Ekonomisk och industriell utveckling, Linköpings Universitet

Linköping University have conducted a series of studies on the life-cycle costs associated with the use of integrated products and services including functional sales models. By life-cycle costs is understood the costs related to the manufacturing, use and disposal of the product throughout its life span. The assessed models lead to reduced use of materials and energy, and significant cost savings are realised from reduced labour costs.<sup>11</sup>

The expert on functional sales models assess that by designing products in a smart way from the beginning, it is possible to reduce 50-60 pct. (or even more) of the resources needed for production and life-span operation of the product. Box 3.1.3 below lists the most important economic and environmental benefits identified.

### Box 3.1.3 Economic and environmental benefits in Functional sales

Economic benefits	Environmental benefits
<ul style="list-style-type: none"> <li>• Lower costs for customers on energy, maintenance and spare parts</li> <li>• Longer product lifetime</li> <li>• Costs of use-phase becomes transparent</li> <li>• Lower risks for the customer due to lower investment level and knowing costs in advance</li> <li>• Cost savings for the service provider</li> <li>• Improved customer loyalty</li> </ul>	<ul style="list-style-type: none"> <li>• Energy and material savings</li> </ul>

## Barriers and drivers

The experts and companies interviewed in this project stress that a main barrier towards functional sales is a traditional mindset among producers/providers and customers. The customers are used to 'own' products and producers/providers and customers strongly focus on price.

Lack of willingness to make changes is a barrier. Many company managers hesitate to make larger changes to their organisation. A lot of knowledge is built into the traditional way of doing things, and making investments to provide functional sales models constitutes a considerable risk. The companies may try to integrate some elements of functional sales but the managers are afraid to go all the way. Another barrier is the way bonus systems are organised in some companies. At management level, the bonus systems are typically based on the sales volume of services and spare parts.

The expert on functional sales holds that lack of integration between divisions in companies is a barrier to the development of new functional sales models. There is usually a division in companies between the engineers that develop the product and the people that develop the services. A higher level of integration between these actors will improve the development of functional sales models.

In both public and private organisations separation between organisational bodies for investments and operation is a barrier. There is often a separation between the financial bodies that are responsible for investments and the bodies responsible for operation. If these bodies are not linked adequately this may be a barrier to make initial investments

that will bring down the operation costs. It is therefore important to have a strong link between these bodies.

Public procurement rules may also be an obstacle to functional sales. Existing regulation may prevent public authorities from demanding functional sales models and from including functional sales elements into their requirements in tender documents. The case company Better Place sees it as barrier that the circulation tax on vehicles deters customers from purchasing electric vehicles.

On the other hand, for producers/providers new business opportunities are an important driver to engage in functional sales. And for both providers and customers the economic benefits affiliated with the model is the main driver for involvement in functional sales. Regulation is also an important driving force for many companies when requirements such as energy efficiency and product recycling are set up. For both companies and customers the environmental benefits associated with the model are important spill-over effects. For companies this also contributes to positive 'green' branding.

A number of barriers and drivers for the dissemination of the functional sales models have been identified and the most important are listed in Box 3.1.4 below.

#### **Box 3.1.4** Barriers and drivers for functional sales

Barriers	Drivers
<ul style="list-style-type: none"> <li>• Customer's traditional mindset</li> <li>• Organisation of bonus systems</li> <li>• Lack of corporate willingness to make changes</li> <li>• Lack of integration between divisions in companies to develop functional sales offers</li> <li>• Public procurement rules may favour traditional business models</li> <li>• Separation in companies between the financial bodies responsible for investments and the bodies responsible for operation</li> <li>• Lack of market demand for functional sales solutions</li> <li>• Lack of knowledge of benefits and life-cycle costs</li> <li>• Tax regulation</li> </ul>	<p>Consumers and Suppliers</p> <ul style="list-style-type: none"> <li>• The economic benefits</li> <li>• The environmental benefits</li> <li>• Regulation</li> <li>• Branding value in saving energy</li> </ul>

## **Recommendations and initiatives**

The expert on functional sales models stresses the need for research on which sectors and product groups that functional sales - from a societal perspective - would be best suitable for, i.e. where the largest socio-economic and environmental benefits would emerge. Through showcases of the best examples of functional sales models, the economic and environmental benefits could be shown to customer and potential service providers. This could potentially convince them of the virtues of the concept. If the industry

realises that providing and demanding functional sales models are in their interest, companies will use the needed resources to develop contract and design products for functional sales models.

The companies and experts interviewed in this project stress that the public sector may also play an important role with respect to promoting functional sales models by demanding functional sales oriented products and services. Within certain sectors a prerequisite for this are improved procurement rules. The companies and experts also emphasise the importance of regulation on creating a market for functional sales models. Regulation on product liability contributes to pave the way for functional sales models where energy and resources are used more efficiently.

The Box 3.1.5. below lists the most important recommendations from companies and experts identified in the project and some typical recommendations and initiatives with regard to disseminating functional sales models in the Nordic region.

#### **Box 3.1.5** Companies and experts recommendations regarding Functional sales

- Regulation and political incentives to save energy and to use and invest in energy saving products
- More research on which sectors and product groups that functional sales models would be best suitable
- Promote demonstration cases to visualize benefits
- Functional sales tailored product design
- Promote functional sales models in public procurement

## 3.2 Energy Saving Companies (ESCOs)

### The model

The ESCO business model<sup>12</sup> makes it possible to carry out energy optimization of buildings or production facilities financed by the savings generated by the optimization process. In its purest form, it means that the customer has no initial investment, but only a pre-set monthly payment to the ESCO company (energy service company). The payment model can be constructed so that costs correspond to actual savings at any given point in time of the project, or so that the customer gets a share of the savings from day one. The ESCO model has generated a number of new companies specialized in reducing the need for energy in buildings and production lines.

In the Nordic countries, the model is mainly targeting public buildings, but it is also used for large energy corporations with substantial energy consumption. The model can also be found in relation to commercial, agricultural, and in some countries residential sectors.<sup>13</sup>

In principle, the ESCO company develops, installs, finances (assumes the financial risk) and maintains performance-based energy optimization of heating, energy or other supply projects of facilities owned by customers (e.g. a school). The ESCO company issues

<sup>12</sup> ESCO is also known as Energy Performance Contracting or EPC

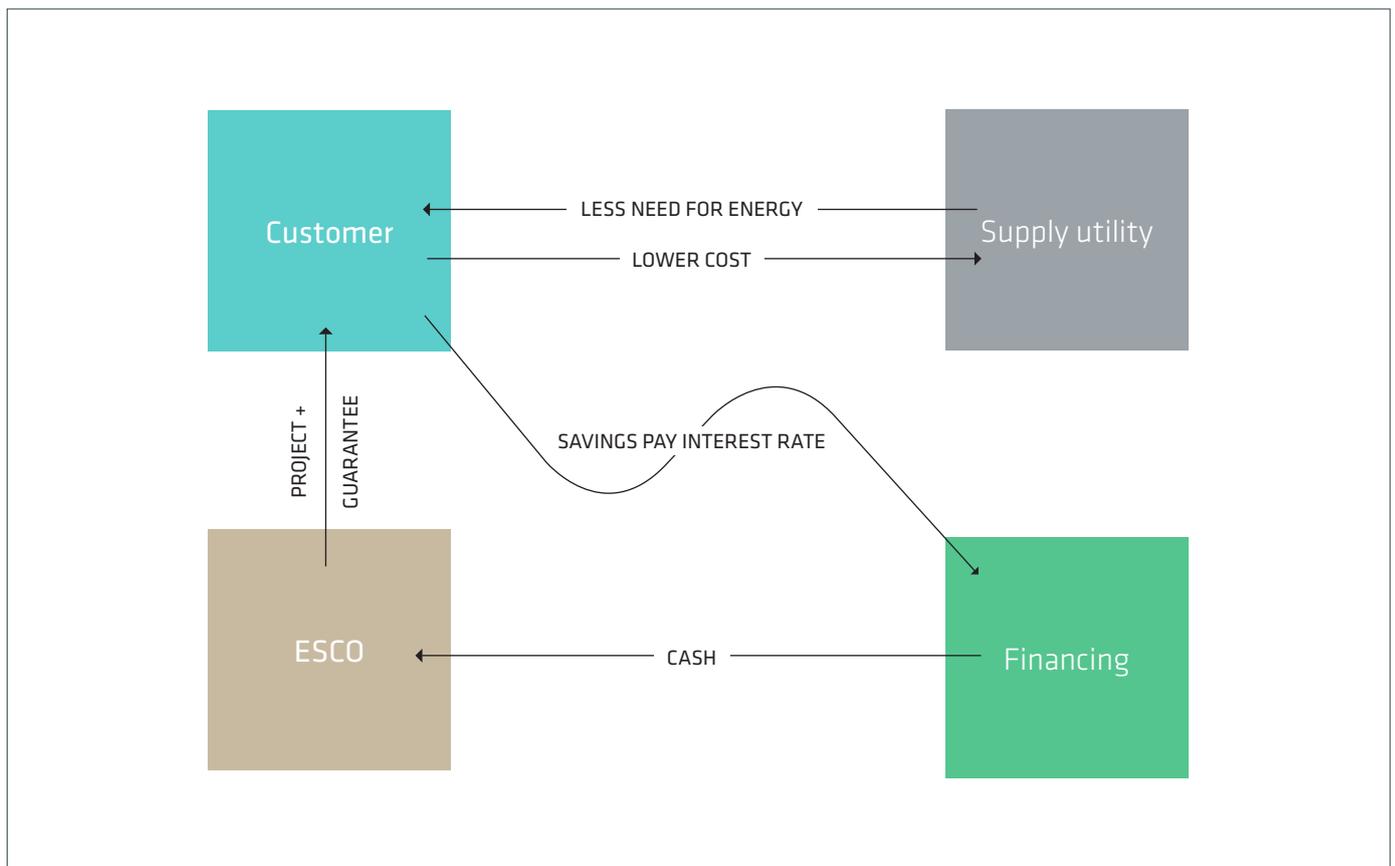
<sup>13</sup> *An International Survey of the Energy Service Company (ESCO) Industry*, 2003, Edward L. Vine

a guarantee up front on the amount of energy savings that the renovation will result in. This guarantee is a cornerstone in gearing the economy in the project. The starting point is to balance savings with expenses over a certain period of time, e.g. 10 years for buildings. Thus the ESCO is paid according to the extent of realised savings on heat, energy or water. Because of the guarantee, the customer gets a project with a transparent and clear financial profile for the full project period. It is often seen that a public customer handles the actual financing themselves, but there will still be a savings guarantee, which means that the ESCO company maintains the primary part of the risk.

As a consequence of the financial risk that the ESCOs carry, they are almost always major companies with a solid financial structure and capacity. Many of them are part of a corporation that produces key components of the renovation project. In that way, they are not only creating value for themselves but also indirectly increasing sales for their sister company.

Illustration 3.2.1 outlines an ESCO setup and the parties involved. An ESCO receives payment in return for a project and guarantee to the customer. The renovation project results in less need for energy and thus lower cost. The savings on the energy bill covers the interest rates on the loan that finances the ESCO and thereby the renovation project.

**Illustration 3.2.1** ESCO setup



The case company Schneider Electric provides ESCO solutions by optimising the clients' energy consumption through application of more efficient technologies, cf. Box 3.2.1.

**Box 3.2.1** Case study: Schneider Electric

The Swedish branch of Schneider Electric provides energy performance contracting (EPC) i.e. ESCO-projects to public authorities who wish to reduce their energy consumption, for example when renovating large groups of buildings. Schneider Electric guarantees their customers a certain level of savings on energy consumption, and financially compensates them if the guaranteed level is not reached. If the project performs better than the guarantee, both partners get a share of the extra savings.

The innovative risk-sharing through the performance guarantee acts as an incentive for customers to enter into a contract with Schneider Electric. For Schneider Electric, the guarantee increases the size of each project, as customers are more willing to enter into large contracts because they have a guarantee of the performance level. The pooling of renovation initiatives leaves room for including initiatives with a poor business case, since they can be financed by the initiatives that have a strong business cases. The number of EPC contracts issued by Schneider Electric has increased steadily since 2002.

The key environmental benefits of EPC projects are the reductions in the use of energy and CO<sub>2</sub> emissions. Considering the 3.6 million m<sup>3</sup> of buildings which Schneider Electric currently has in its portfolio, they estimate that they have saved 130 000MWh annually in energy consumption.

An example of this business model is Schneider Electric's EPC contract with RegionFastigheter – the office of property services for public hospitals in southern Sweden. The project has brought about annual energy savings of EUR 1.1 million. Savings exceeding the guaranteed savings are divided equally between Schneider Electric and RegionFastigheter. The total capital value of the project is EUR 10.5 million, and the investment will be returned in 9.5 years. The project has led to an annual reduction of CO<sub>2</sub> emissions of 3 886 tons, and a reduction of water consumption of 55 900 m<sup>3</sup>.

By entering into the contract, RegionFastigheter has significantly reduced its operation and maintenance costs, at the same time considering the environment. Schneider Electric estimates a significant potential for developing this green business model in the Nordic countries.

The ESCO model is also used for other areas. For instance it has proven to be valuable in the heavy industry as a tool for reducing energy consumption in manufacturing processes. The ESCO model is becoming increasingly interesting as the energy costs are moving into the top 3 of cost categories in many of these companies. The company Danfoss Solutions has made a solid business case on ESCO projects with large private companies, cf. Box 3.2.2.

**Box 3.2.2** Case study: Danfoss Solutions A/S

The Danish company Danfoss Solutions A/S makes ESCO projects and guarantees energy savings for industrial companies primarily in the food and beverage markets. Danfoss is paid according to performance and compensate the customer if savings are less than guaranteed. Their focus is on saving energy with existing technology and through the involvement of people.

In an average project, Danfoss' customer save approximately EUR 500 000 per year and reduces their emission of CO<sub>2</sub> by 3 000 tons. In an average project, 10-25 pct. of total utility costs are saved with less than 3 years return of investment period. In most ESCO projects the customers also gain new knowledge and better control of processes which leads to better performance quality, and also their future maintenance cost of systems and installations are reduced.

One of Danfoss' customers, the brewery Carlsberg, saved approx. EUR 0.7 million and reduced their emission of CO<sub>2</sub> by 2 500 tons equal to 10 pct. of their energy use with a return on investment period under 2 years. Another customer, the food producer BISCA, saved EUR 0.3 million and 1 200 tons CO<sub>2</sub> equal to 20 pct. of their energy use with a return on investment period of 2 years.

Danfoss estimates the turnover of industrial ESCO projects in general in Denmark to be less than EUR 7 million per year, but they expect the economic potential of Danish ESCO projects to be as high as around EUR 0,4-0,5 billion per year and around EUR 20 billion per year for the European ESCO industry.

In general, there are three broad financing options for energy efficiency improvements. Either the customer finances the improvements with internal funds or the ESCO company finances the improvements. The third model builds on third party financing (e.g. loan from a bank) which can be established as a loan to either the customer or the client.

## Market potential

The ESCO industry in the US has been a success story. Turnover has rapidly increased with annual growth rates of roughly around 20 pct. since the 1990s. The turnover estimated to be around USD 5.25 billion in 2008. In Europe, the European Commission estimates that the market for ESCOs can develop to a volume in the range of EUR 5-10 billion per year within a short-term perspective in the EU. Alone in Germany, which is considered the most mature market, there are about 500 ESCOs with an annual turnover of EUR 3 billion.<sup>14</sup> This gives reasons to believe that there is also an unrealised ESCO potential in the Nordic countries where ESCOs in general are not widespread.

There is a clear connection between carrying out an ESCO project and generating environmental improvements. Operating residential and commercial buildings account for more than 15 pct<sup>15</sup> of all green house gas emissions globally, according to the World Resource Institute<sup>16</sup>. Most of the existing buildings are old and poorly insulated with in-efficient heating, energy and other supply installations. Thus the ESCO business model overall provides a significant potential for a reduction of energy and green house gas emissions in the Nordic countries where fossil energy is used for heating etc. All companies and the experts in the study state that the model brings about environmental benefits.

<sup>14</sup> Energy service companies in European countries: Current status and a strategy to foster their development, 2006, Paolo Bertoldi, Silvia Rezessy, Edward Vine.

<sup>15</sup> Often you hear that 40 pct. of all carbon emission is related to buildings. However, carbon emission related to production of services and goods produced outside Denmark, that we purchase and use, is not part of this calculation. Thus it is not a complete carbon foot print, and the buildings get a proportional larger share of the carbon emissions.

<sup>16</sup> <http://www.wri.org/chart/world-greenhouse-gas-emissions-2005>

## Economic and environmental benefits

The ESCO business model generates multiple benefits for the supplier, the customer, the environment and the end user of the buildings. The most important financial and environmental benefit is lower energy cost for the customer through a reduced need for energy. This has been the case for all case companies in the project. Schneider Electric also has converted from increasingly expensive fossil fuel to renewable energy as key part of their project. Another important positive factor is that the projects in general create improvements in the indoor air quality which again improves the employees' ability to maintain concentration and to focus. Also, ESCO projects may involve a general upgrading of skills for the customer's staff increasing their motivation. The Box below lists the most important economical and environmental benefits identified in this project.

### Box 3.2.3 Economic and environmental benefits in ESCO

Economic benefits	Environmental benefits
<ul style="list-style-type: none"> <li>• Energy costs savings due to reduced need for energy and conversion of energy sources</li> <li>• Reduction of maintenance costs and prolonged product lifetime</li> <li>• Indoor climate is often improved leading to less sick leaves and improved conditions for focusing and concentrating</li> <li>• Spin-off innovations and new technical solutions invented along the implementation</li> <li>• CSR value and branding for both customers and suppliers</li> <li>• Educational/practical training leading to increased motivation and inspiration for staff/users</li> </ul>	<ul style="list-style-type: none"> <li>• Energy and waste reduction, use of renewables and replacement of oil and gas</li> <li>• Better comfort from improved indoor climate</li> <li>• Faster introduction of environmental friendly technologies</li> <li>• Change of attitude towards a more sustainable behavior</li> </ul>

## Barriers and drivers

There is a series of barriers related to the mindset of the customers both at the management/political and procurement level. A common denominator is a lack of insight into and knowledge about the model, and existing structures and institutional habits regarding renovation projects. These framework conditions all together cause the decision makers and procurement staff to be reluctant in pursuing the opportunities of the ESCO model.

Another key barrier is the lack of willingness to prioritise funding for the ESCO projects internally in companies due to the longer pay back period that most often are found in these projects. As the economy is right now, there is also a growing competition internally in the organization between projects that require funding in some form.

The main driver for establishing new ESCO projects is the positive financial aspects that are at the core of the model. Across the cases in this project, branding is found to be an

important driver. The transparency in the investment is favoured as an important driver.

All together, a number of barriers and drivers for the dissemination of the ESCO model have been identified and the most important are listed in Box 3.2.4. Note that there may be variations from country to country as well as from sector to sector depending on for example market maturity, size of the market etc.

#### Box 3.2.4 Barriers and drivers for ESCO

Barriers	Drivers
<ul style="list-style-type: none"> <li>• Traditional mindsets and routines amongst politicians and public procurement staff may hinder long-term contracting and public outsourcing</li> <li>• Lack of regulation and government support for energy renovations</li> <li>• Lacking knowledge among customers, consultants and financial institutions about economic benefits of ESCO projects</li> <li>• Customer's lack of trust to supplier and reluctance to commit to long term contracts</li> <li>• Lack of focus at customer's management level</li> <li>• Lack of capital for initial investments and for smaller projects. Projects are perceived to be more risky</li> <li>• Competition for scarce capital with more traditional investments</li> </ul>	<p>Consumers</p> <ul style="list-style-type: none"> <li>• Saving of energy and costs</li> <li>• Branding value in saving energy</li> <li>• Reduced risk of new investments</li> <li>• Buildings that need to be renovated</li> </ul> <p>Suppliers</p> <ul style="list-style-type: none"> <li>• Earnings</li> <li>• Increased education and information of consumers and financial institutions</li> <li>• Potential market size</li> <li>• Regulation and public demand</li> </ul> <p>Consumers and Suppliers</p> <ul style="list-style-type: none"> <li>• Regulation to save energy and reduce CO2 emissions</li> <li>• Rising energy prices</li> </ul>

### Recommendations and initiatives

The experts and companies working with the ESCO model all agree that the full potential of the ESCO model is far from being utilized. This is the case even though energy prices are rising, framework conditions are improving and many companies are becoming more focused on climate and sustainability as a branding factor. The recommendations from companies and experts can be broken down into the following categories: initiatives that support increasing awareness about ESCOs, improvements in framework conditions like procurement regulation and standard contracts, and finally supporting access to the necessary funding.

The most important recommendations from companies and experts in the project and some typical recommendations and initiatives with regard to disseminating ESCO model are summarized in Box 3.2.5.

**Box 3.2.5** Companies and experts recommendations regarding ESCO

- Political incentives for energy savings, for example access to funding and integration of ESCO into public procurement
- Introduce a certification of ESCO providers to avoid customer uncertainties
- Standardise contracts, measurement and verification for ESCO projects
- Promote ESCO in local, regional, and government buildings
- Take a strategic approach towards ESCOs to be a Nordic position of strength. Set up an organization, export knowledge etc.
- Promote the ESCO models via demonstration projects and increased information about benefits for customers, providers and financial institutions
- Set up financial support for energy savings by environmental loans, a third-party financing network etc.
- Make new international accounting rules for credit ratings so the customers do not need to carry the liability in their books for the project, and thus potentially make the company's credit rating look worse although the return of investment of ESCO projects is guaranteed

## 3.3 Chemical Management Systems (CMS)

### The model

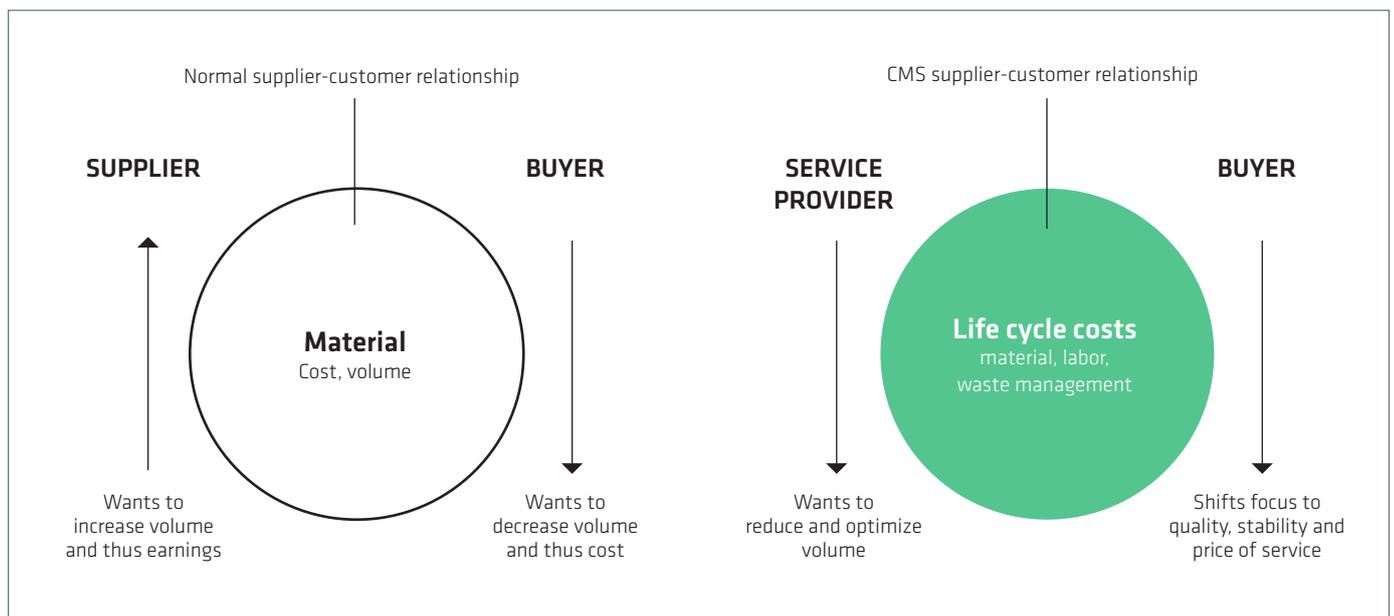
Chemical management systems (CMS) is a business model in which a company having chemical processes in their production, engages with a supplier in a strategic, long-term contract to supply and manage the customer's chemicals and related services. Thus the relationship changes from a traditional customer-supplier relation to a strategic partnership regarding a certain service. The supplier to some extent becomes an imbedded part of the customer's production system. From a business model point of view, this change in relationship is the main innovative element of the business model.

Traditionally, the supplier earns his profit by maximising the volume of sold chemicals (e.g. litres of solvents, reactants, cleaners etc.). Under a CMS contract the supplier earns his profit by managing chemicals and by carrying out a service (e.g. painting body parts for cars). Thus the supplier has an incentive to minimize the use of chemicals, energy etc. and developing innovative solutions on how best to carry out the service.

CMS often results in a sound business case for the supplier, a lowering of the environmental impact, a closer relationship with the client and innovation. A survey by the EU Commission from 2006 indicated that a majority of companies using CMS increased their competitiveness due to CMS, expected increasing competitiveness and growth in the future, and have reduced chemical volumes.

CMS is characterized by the service provider taking a direct role in, or taking responsibility for, handling a part of the production process. This changes the incentives from wanting to increase the volume of chemicals (and thus costs) for the supplier of chemicals to wanting to decrease the volume of chemicals. For the customer it changes the perspective from lowering the costs related to buying the chemicals to focusing on the quality, stability and price of the service, cf. Illustration 3.3.1. See also the example of Kemira Operon in Box 3.3.1 and AGA Gas in Box 3.3.2.

**Illustration 3.3.1** Change of supplier-customer relationship in CMS models



Source Adapted from M. Stoughton, T. Votta / Journal of Cleaner Production 11 (2003)

**Box 3.3.1** Case study: Kemira Operon

Kemira Operon - a Finnish branch of the global chemical company Kemira - provides services in operating and managing industrial and municipal wastewater and sludge treatment processes.

Kemira Operon recovers acids, bases and metal hydroxides, primarily aluminum and iron. The concentration of the metals is increased through refinement and standardized to a level where the metal hydroxides can be recycled as raw material in chemical production. Some recovered renewable raw materials can be used as such in the wastewater treatment plants that Kemira Operon Oy is operating. To the extent possible, Kemira Operon aims at reusing the recovered metal hydroxides in geographical proximity.

At present time, metal recycling reduces the disposal volume to dumping areas by around 2 000 t/a. For acids and bases recycling, the reduced volume constitutes around 3 000 t/a.

The services provided are cheaper than traditional wastewater treatment, and the wastewater is handled in a sustainable way. Resource savings are achieved through the reduced demand for neutralizing chemicals and less waste that needs to be disposed in landfills.

Kemira Operon estimates that up to 50 000 tons of solid landfill are avoided on a yearly basis because of the business model Kemira Operon uses.

The long-term service contracts with Kemira provide the customers with a sustainable and predictable outlet of waste. Additionally, the customers avoid high waste taxation and unpredictable rules and risks.

**Box 3.3.2** Case study: AGA Gas

Swedish AGA Gas offers its customers to continuously introduce safer chemicals at lower consumption levels and with less hazardous waste disposal. Applying the business model of chemical management services (CMS), AGA Gas reduces their customers' chemical procurement costs by reducing their use of chemical products and getting better procurement deals from suppliers.

The customers are offered to reduce their risks of dead stock, getting a just-in-time delivery of chemicals and improving the data management of the chemicals. AGA Gas offers its customers repacking and the possibility of ordering smaller quantities of chemicals, which means that customers do not have to store chemicals unnecessarily. This service leads to less scrap, less stock-keeping and a safer working environment.

As a CMS provider, AGA Gas also helps their customers with international chemicals regulations, ensuring that their purchases comply with legal requirements. AGA Gas' experience is that the purchase price of a chemical reflects approximately one-fifth of the total cost during its life cycle. Thus, the company saves its customers money by reducing prices while at the same time focusing on the handling and administration costs.

CMS is still a relatively immature business, and customers are often more interested in the environmental and safety aspects than in the actual prices.

No numbers exist of how much the amount of chemicals and CO<sub>2</sub> are reduced by the business model, as it varies between the company's customers. AGA Gas is able to reduce the cost of managing the different chemicals, concentrating the volumes into one brand, which lowers product prices.

AGA Gas hopes to increase its business in the future, creating synergy effects between different branches and industries, with a goal of increasing the benefits for their customers in terms of environmentally and financially sound solutions.

In practice, one finds a great variety of chemical management services, ranging from simple outsourcing of chemical purchasing functions to service providers, to comprehensive service packages provided on a long-term basis. CMS gives incentives to efficiency improvements to the manufacturing process itself. This can be via improved inventory control (e.g. reduced spoilage), via delivery to point-of-use (e.g. reducing wastage due to inappropriate container size), or via the ability of a supplier to find resale options for unused or unneeded chemicals. With respect to life cycle costs, most experts state that CMS allows customers to reduce their costs by a more accurate management and application of chemicals.

## Market potential

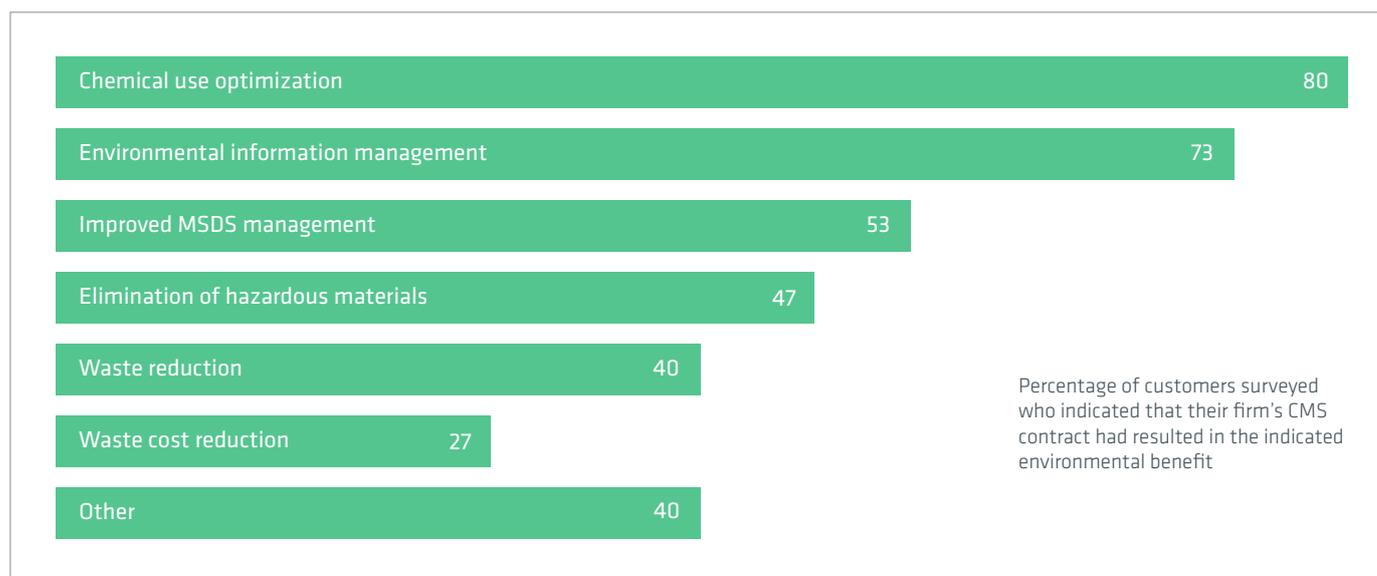
In EU15 the total turnover for chemical industry in 2006 was EUR 533 billion with CMS responsible for approximately 2 pct. (EUR 9 billion). The European Commission has estimated the potential turnover for CMS to be EUR 77 billion or 14 pct.<sup>17</sup> There is no record of a corresponding estimate for the Nordic countries.

In Europe, CMS is to a wide extent applied within the automotive and aerospace industries. CMS is growing in Europe but is not applied as widespread as in the US. Experiences from the US show that the economic net benefits from CMS are estimated to be around 5-20 pct. of the chemical purchasing and handling costs in the first year of implementation. CMS generates the highest amount of cost savings during the first two years.<sup>18</sup>

The case studies of this project also indicate that the business potential for CMS is significant in the Nordic countries. The case company Argentum estimates that more than 3000 companies in Sweden alone are legally obliged to carry out the tasks that Argentum provide. The expert interview on CMS also created ground for the conclusion that as a business model CMS has potential in the Nordic countries.

The CMS model also clearly provides significant environmental and public welfare benefits as it leads to a reduction of chemical use. The case companies Kemira and Argentum support this statement, the latter company reporting a potential for reducing the customer's consumption of chemicals with at least 10-20 pct. In addition, the model seems to drive a process of substituting of chemicals towards less hazardous substances with corresponding benefits for the environment as well as for occupational health. Illustration 3.3.2 shows the different environmental benefits of CMS.

<sup>17</sup> <sup>18</sup> *Chemical product services in the European Union, 2006*, European Commission, D.G. Joint Research Centre

**Illustration 3.3.2** Environmental benefits

Source M. Stoughton, T. Votta / Journal of Cleaner Production 11 (2003)

**Economic and environmental benefits**

The most interesting economic reason for choosing CMS as a business model is that it provides a sound basis for business. CMS reduces the cost related to chemicals for both the supplier and the customer. It ties the customer closer to the supplier, it creates long term contracts and it reduces the shared risks.

Likewise, the business model provides significant results from an environmental point of view. First and foremost, it reduces the amount of chemicals used and it creates a stronger focus on substituting hazardous chemicals. This in turn also means improvements in health and safety issues for the workers due to safer chemicals.

Finally, CMS reduces the amount of waste generated and offers opportunities for pursuing advanced sustainability recycling solutions like Cradle to Cradle (see the section 'Other green business models'). The most important economic and environmental benefits of the CMS model identified in this project are listed in Box 3.3.3 below.

**Box 3.3.3** Economic and environmental benefits in CMS

Economic benefits	Environmental benefits
<ul style="list-style-type: none"> <li>• Increasing business opportunities for suppliers working with CMS</li> <li>• Reduction of chemical costs due to CMS procurement</li> <li>• Reduced risks for dead stock due to just in time delivery and improved data management</li> <li>• Reduction of administration costs in SMEs.</li> <li>• Reduction of risk costs related to work safety, production process, deliverance etc.</li> </ul>	<ul style="list-style-type: none"> <li>• Reduced use of chemicals</li> <li>• Substitutes for hazardous chemicals</li> <li>• Reduced amounts of waste</li> <li>• Work environment improvement due to safer chemicals</li> <li>• Potential for Cradle to Cradle set-up</li> </ul>

**Barriers and drivers**

One of the most significant barriers to further disseminate the CMS business model according to all case companies and experts is a lack of knowledge about the model in the business community. Furthermore, the case companies states that it is difficult to assess the appropriate management level needed to make the shift from traditional purchasing of chemicals to entering a contract with a chemical management company.

As a consequence of the shift in ways of purchasing and handling the chemicals, the contracts for CMS are rather complex compared to regular purchasing. And it is even more complex in an international context due to the diversity in standards and administrative procedures in the different countries. The CMS model also opens up the discussion of how close a connection a company wants to have with a supplier. Strong and long lasting connections gives the benefit and insight of partnerships, but it reduces the opportunity to shift suppliers.

On the other hand, there are significant drivers for entering into the CMS business model. For the suppliers, the key drives are increasing business opportunities. This goes for all cases this project has examined. Furthermore, savings and regulation (for example, the requirement of safety data sheets for all chemicals) are identified as important drivers for the suppliers. For the customers, the most important drivers identified in the project are reduced production and chemicals costs and the opportunity to concentrate on the core business. Another important driver is that operating with a CMS contract leads to control of health and safety issues.

Box 3.3.4 below lists the most important barriers and drivers that have been identified in this project and in available reports on CMS.

**Box 3.3.4** Barriers and drivers for CMS

Barriers	Drivers
<ul style="list-style-type: none"> <li>• General lack of customer knowledge about the business model: It is difficult for the suppliers to communicate benefits, and it takes a lot of resources. Lack of good reference cases</li> <li>• Lack of customer knowledge on life-cycle costs that is real cost associated with chemical usage</li> <li>• It is difficult for the suppliers to get in contact with management. The wrong cost centre sees CMS as leading to job loss</li> <li>• Customers CEOs seem to be less willing to budget adequately to improve the environmental impact of the company</li> <li>• Contracting CMS is more complicated than selling/buying products, especially across European countries</li> <li>• Dependency from long-term contracts making it difficult for customers to switch to other suppliers</li> <li>• Lack of customer trust to suppliers with confidential process information</li> <li>• Extra supplier investment for equipment, infrastructure and labour and more fixed cost</li> </ul>	<p>Consumers</p> <ul style="list-style-type: none"> <li>• Reduced production and chemicals costs</li> <li>• Concentration on core business</li> <li>• Environmental, health and safety advantages</li> <li>• Reduce the complexity of chemical management</li> <li>• Limitation of liability risks</li> <li>• Efficiency improvement of production</li> </ul> <p>Suppliers</p> <ul style="list-style-type: none"> <li>• New business opportunities</li> <li>• Regulation (like requirement of safety data sheet of all chemicals as the suppliers has the expertise)</li> <li>• Consolidation of the market and enhanced customer loyalty</li> <li>• More value from their human resources: expertise and know-how</li> <li>• Capture added value from customers</li> </ul> <p>Consumers and Suppliers</p> <ul style="list-style-type: none"> <li>• Aligned incentives for customers and suppliers</li> <li>• Better environmental performance</li> <li>• Partnership for innovation between customers and chemical suppliers</li> </ul>

**Recommendations and initiatives**

The experts and companies involved in this project state that the CMS model has a potential both as a driver for business improvements and for environmental improvements. There are several recommendations which call for governments to further promote recycling and reduce waste through different incentives like taxation of toxic materials. Other recommendations goes towards developing the actual model so that it imbeds other sustainability issues and are made available for small and medium size companies. Such initiatives will make CMS even more attractive.

The table below lists the most important recommendations and initiatives identified in the project by companies and experts and some typical recommendations and initiatives with regard to disseminating CMS, cf. Box 3.3.5.

**Box 3.3.5** Companies and experts recommendations regarding CMS

- Make economic incentives for recycling and for waste reduction, e.g. putting a tax on toxic materials
- Waste management should be included in the business model – not just in theory but in reality
- Develop more simple versions of the business model that may be relevant for SMEs, since CMS is less suitable for SMEs
- Public financial support to assess the potential for broadening the scope of the CMS model to integrate sustainability issues like energy and green house gas emissions
- Customer's whole life-cycle should be outsourced to CMS including waste management so that the full potential is harvested
- The environmental managers in the companies should be part of the board of directors
- Investigate whether there is a potential for local government support for companies' CMS activities

## 3.4 Design, Build, Finance, Operate (DBFO)

### The model

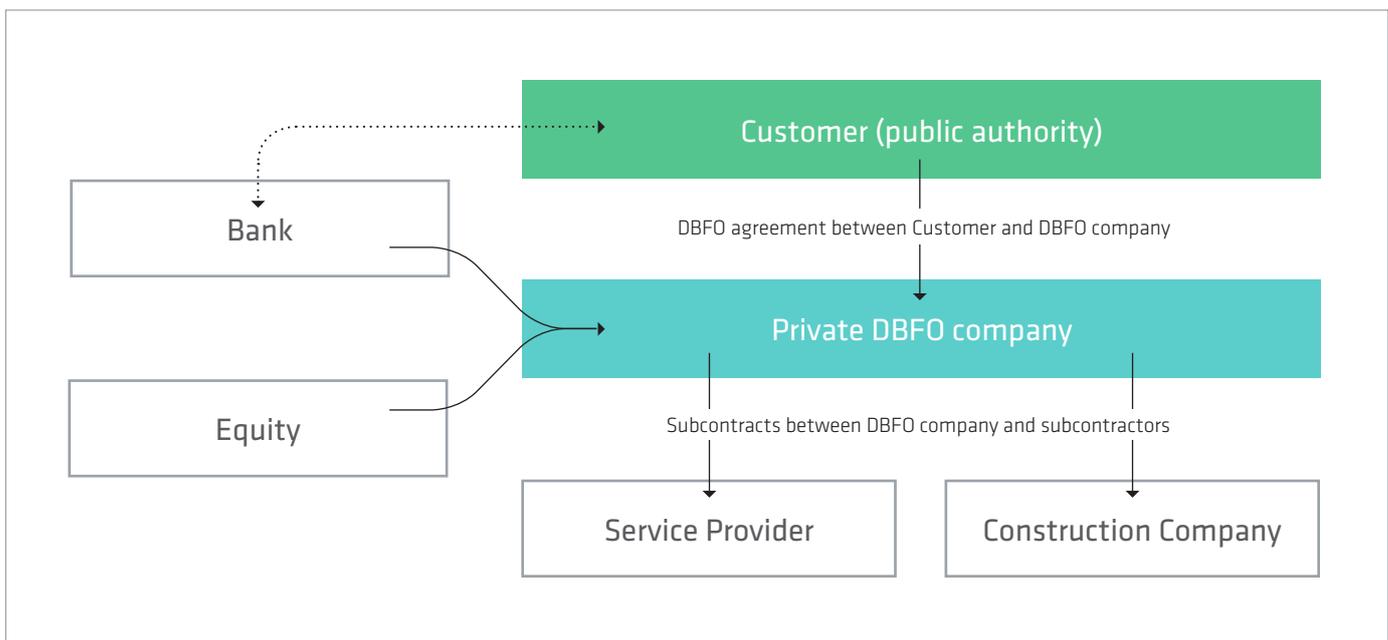
The Design, Build, Finance and Operate (DBFO) business model is a form of public-private partnership (PPP) - typically involving a public organization (the customer) and a private organization (the provider). The provider is responsible for the design, construction, finance and operation/maintenance of an infrastructure asset (for example, schools, hospitals, roads, bridges and ports). Innovative elements of the model are the use of private finance and the coupling of the design and construction stages with the operational/maintenance stages. This encourages the provider to design and build buildings etc. that can be operated and maintained in an effective manner (see the case examples in Box 3.4.1 and Box 3.4.2 below). The provider is responsible for not only building the asset on time and to the budget but also for effectively operating and maintaining the asset over a long term period, typically 30-35 years.

A key advantage of the DBFO model is this division of risk between the client and the provider. For example, if a building turns out to be more expensive than expected, then it is the provider who will carry the extra cost. Similarly, if agreed service and maintenance levels are not fulfilled, there will be deductions in the monthly payment fee from the customer. In short, if the provider does not perform, he will be financially penalized.

In public institutions like municipalities, regional and state run buildings etc. the budget can be under pressure from different sides and, this may lead to cuts in operation and maintenance budgets. The DBFO model contributes to proper maintenance of public assets in the long run because the private provider is contractually obliged to operate and maintain the asset according to specified standards for the full contract period.

In a typical setup of a DBFO model, there is one main DBFO contract between the customer and the private provider (DBFO company) as illustrated below. The DBFO company will typically be a project company which is subcontracting the design, construction, maintenance and operation tasks to subcontractors.

**Illustration 3.4.1** Typical DBFO setup



The Finnish company Arandur Oy, which successfully has run a combined school, sports and education centre since 2003 with a project sum of EUR 120 million, illustrates a classical example of a DBFO model, cf. Box 3.4.1.

**Box 3.4.1** Case study: Kaivomestari - secondary school, swimming hall and sports centre

The Kaivomestari senior school, swimming hall and sports centre is the first Design, Build, Finance and Operate (in short DBFO) project in the real estate sector in Finland. The project is a public-private partnership between the project company Arandur Oy and the City of Espoo reaching a total value of EUR 120 million.

Arandur Oy designed and constructed the building in 2001-2003 and is now responsible for maintaining and operating it for a period of 25 years. The DBFO business model gave Arandur Oy an incentive to adopt a total life-cycle approach to the project and integrate the design and building stages with the operation and maintenance stages.

The life-cycle approach has resulted in innovative technical and service solutions that are expected to reduce the operation and maintenance costs including energy costs.

Arandur Oy carries the risk for cost overruns which was one of the major benefits for the City of Espoo. Arandur Oy in return has obtained a stable income for a 25-year period.

Arandur Oy estimates that the market potential for projects based on the business model of DBFO is EUR +500 million annually in Finland alone. The business model can be used in a variety of sectors including health, transport and industry.

Another typical example of the DBFO model is the Norwegian road project E39 Lyngdal-Flekkefjord. This project was implemented in 2004, and the road opened in 2006. There have been some interesting results from this project, including some technical innovation with environmental benefits (see Box 3.4.2).

**Box 3.4.2** Case study: E39 Lyngdal-Flekkefjord

E39 Lyngdal-Flekkefjord is a Norwegian DBFO road project. The customer is the Norwegian Public Roads Administration (NPRA), and the project company is Allfarveg AS. The contract covers the road section E39 Lyngdal-Flekkefjord, at the length of 38 km, 18 km of which is newly built road and 20 km is existing road.

The DBFO contract between NPRA and Allfarveg covers the period 2004-2031. The road opened in September 2006, two years ahead of time, and the total project construction value was approximately NOK 1.3 billion. Allfarveg is responsible for designing, building, financing, operating and maintaining the road during the contract period. Allfarveg receives payment based on their performance. The performance payment fee is based on four main elements (accessibility, operational standards, traffic forecast payment and a safety payment). If Allfarveg fails to meet agreed performance standards, or if the accessibility of the road is reduced, the monthly fee from NPRA will be reduced. If the number of traffic accidents is reduced more than expected a bonus payment will be released.

The incentive structure of the DBFO contract has encouraged Allfarveg to come up with innovative technical solutions, such as using brighter stones in the road asphalt. Because less light intensity is required to light up the road, this has led to a 30 per cent saving in electricity costs. According to a representative from Allfarveg, lightning is a significant operational cost on road projects, and this is a promising green side effect of the E39 Lyngdal-Flekkefjord project that can be expanded to future projects.

Allfarveg suggests that more focus on the environmental potential of the model may lead to a greater realisation of environmental benefits on future projects. Allfarveg estimates that the model is suitable for application in other sectors, e.g. the building sector, and presumably also in other Nordic countries. However, international experience suggests that careful estimation of the benefits and disadvantages of the model has to be made in each instance.

An additional DBFO project on waste water treatment in Finland (Watrec Ltd.) has been included in the project. All case descriptions are available in full length – see Annex.

**Market potential**

The market potential has previously been estimated to be substantial.<sup>19</sup> But the dissemination of the DBFO model is rather limited in the Nordic region. In Denmark, the market potential has been estimated to be in the range of EUR 3–3½ billion for the period 2005–2010.<sup>20</sup> The analysis of the Danish market covers six sector areas including: municipal, regional and state level roads, state owned railroads, municipal waste water treatment, public schools at the municipal level, and public housing for elderly people.

The case company Arandur Oy (see Box 3.4.1 above) estimates the potential in Finland for projects like Kaivomestari to be EUR 100–500 million a year. Another Finnish case company, Watrec, estimates the potential for similar waste water treatment DBFOs in Finland to be EUR 100–300 million and in the Nordic countries to be EUR 500–1 000 million. Evaluations of PPP suggest cost reductions in the range of 10–20 pct (for example, National Audit Office 2000). It has also been estimated that this type of business model to a higher extent delivers on time and within budget compared to traditional procure-

<sup>19</sup> Promoting Innovative Business Models with Environmental Benefits, 2008, COWI. Report produced on behalf of the EU Commission.

<sup>20</sup> See Erhvervs- og Byggestyrelsen, 2005. OPP-markedet i Danmark 2005–2010. København: EBST.

<sup>21</sup> Promoting Innovative Business Models with Environmental Benefits, 2008, COWI. Report produced on behalf of the EU Commission.

<sup>22</sup> For an overview of this debate, see Greve, Carsten and Graeme Hodge. 2007. Public-Private Partnerships: An International Performance Review. Public Administration Review 67(3): 545-558.

ment models. One study suggests that while only 27 pct. of traditional infrastructure projects are delivered on time, PPPs deliver 78 pct. on time (National Audit Office, 2003). The expert interviewed on DBFO in this project assesses that the potential is difficult to estimate.

On a global scale, the UK is by far the most matured market for DBFO models (PPP). In the period from 1995 to 2007, more than 750 PPPs were implemented in the UK with a total value of approximately EUR 43.9 billion<sup>21</sup>. There is no comprehensive study of the Nordic market potential. Moreover existing evaluations of the performance of DBFO projects have been criticized for their methodology.<sup>22</sup>

## Economic and environmental benefits

The bundling of design and construction with service and maintenance elements in the DBFO model can lead to economic and environmental benefits such as innovative divisions of risks, new innovative and energy efficient solutions, lower maintenance costs and a prolonged lifetime of buildings and installations. The risk division and the bundling of the design/construction phase with the operation/maintenance phase bring about innovative design and technical solutions (including environment friendly solutions as this may reduce operation and maintenance costs). This mechanism took place when the case company Arandur Oy decided to turn the Kaivomestari building 180 degrees from the original plan due to energy consumption considerations. The risk division also ensure that infrastructure assets are properly maintained in the long run. Further, the risk division encourages the provider to complete the construction phase on time and within budget as cost overruns typically will be carried by the provider. In the Norwegian DBFO case the construction of a road was finished 1-2 years ahead of time. Box 3.4.3 below lists some of the most important economic and environmental benefits identified in this project.

It should be noted that there is a lack of comprehensive evaluations. Moreover there are studies that point in different directions in relation to the performance and advantages and disadvantages of the model (see Greve and Hodge 2007). Further, no studies of the environmental potential of the DBFO model have been identified in this project. This Green Paper focuses primarily on the benefits and the potential of the analysed business models.

### Box 3.4.3 Economic and environmental benefits in DBFO

#### Economic benefits

- Projects are kept within budget
- Projects are completed on time
- A more optimal division of risks
- Properly maintained assets innovation; due to the total life-cycle approach and risk division, providers are encouraged to come up with innovative technical / design solutions that help reduce operation and maintenance costs in the long-run

#### Environmental benefits

- Incentives for reducing energy costs (due to the total life cycle approach)
- Incentives to invest in environmental efficiency for the long run
- Environment-friendly solutions can be designed and developed by technical experts early in the process (because of the integration of the design and construction phase with the operation/maintenance phase)

## Barriers and drivers

As the public institutions are uncertain of the risks and the real economic and environmental benefits from applying this model they are reluctant to entering such long term partnerships. 'Unclear economic benefits' are rated by the interviewed companies as being the most significant barriers for the model. Moreover, the business model involves complex contractual agreements, which means that the transaction costs for entering DBFO agreements are high. Uncertainties concerning the calculation of project risk may also be a barrier. The providers calculate and put a price on the risks that they carry in the project. Another barrier is the loss of flexibility as the agreements typically cover several decades. A further barrier identified in this project is the lack of a firm and strategic political commitment to DBFO type of projects. Finally, a weak regulatory framework might be an obstacle to the dissemination of DBFO.

However, the model has some strong drivers for its application. For the public institutions, the customers, it is an important driver that projects are completed on time and within budget, that the public infrastructure is properly maintained, and generally that the public gets value for money. For the private contractors long term profits is the most important benefit, but also the larger portfolio of assignments is an important driver for entering DBFO agreements. The most important barriers and drivers for DBFO identified in this project are listed below in Box 3.4.4.

### Box 3.4.4 Barriers and drivers for DBFO

Barriers	Drivers
<ul style="list-style-type: none"> <li>• Lack of insight into environmental impacts</li> <li>• Lack of comparative studies /evaluations that document benefits</li> <li>• Transaction costs due to complex procurement model</li> <li>• Uncertainties concerning the calculation of risk among customers</li> <li>• Loss of flexibility due to long-term contracts.</li> <li>• Private finance is as a general rule more expensive than public finance</li> <li>• Weak regulatory framework<sup>23</sup></li> <li>• A lack of political commitment and support</li> </ul>	<p>Consumers</p> <ul style="list-style-type: none"> <li>• On time and within budget delivery</li> <li>• Properly maintained infrastructure</li> <li>• Savings and better 'value for money'</li> <li>• Innovations from combining design and construction with service and maintenance</li> <li>• More optimal risk-division</li> </ul> <p>Suppliers</p> <ul style="list-style-type: none"> <li>• Long term earnings and profits</li> <li>• Promising financial asset that is attractive to invest in after project delivery</li> </ul>

<sup>23</sup> In Denmark, for example, there has been some ambiguity concerning VAT rules and deposit requirements at the municipal level.

## Recommendations and initiatives

In order to disseminate the model, some of the companies and experts involved in this project have suggested that public authorities need to take a more strategic approach towards DBFO projects to ensure a critical mass of projects, which will ensure competition among the bidders. Another comment has been that public institutions need to have the right capacity to manage this type of projects, and also to be more aware of the high environmental potential from applying these models, for example by introducing green elements in the public procurement and payment mechanism. Public authorities are encouraged to conduct a comprehensive study on the effects and results of DBFO projects, to standardize DBFO contracts, to promote demonstration projects and disseminate lessons learned, to promote innovation friendly legislation, and finally to focus on quality as well as price when choosing supplier.

The most important recommendations from companies and experts in the project and some typical recommendations and initiatives with regard to disseminating the DBFO model are summarized in Box 3.4.5.

### Box 3.4.5 Companies and experts recommendations regarding DBFO

- Ensure the right institutional capacity to manage the projects in the public sector
- More focus on the possible environmental benefits involved in these projects
- Conduct a study on effects, results and evidence
- Adopt a strategic approach to ensure a certain project pipeline
- More innovation-friendly legislation with less administrative burdens, more flexibility and avoidance of contractual lock-in
- Focus on quality as well as the price when choosing supplier
- Promote demonstration projects
- Standardize contracts to reduce transaction costs
- Disseminate lessons learned and increase information about the model
- Unambiguous and robust regulatory framework

## 3.5 'Sharing' businesses

### The model

The basic idea of 'sharing' business models is that instead of private ownership, the product is shared among a number of users, whenever the individual user needs access to the product. The economic benefits of this model are less evident compared to the other business models described in this Green Paper but the sharing of products may pave the way for new products to the market. If products are expensive and/or the technology is new to the consumer, product sharing may be a way to make the product available to the user, without the users having to take the risks and liabilities related to owning the product.

Additionally, the model has the advantages of products being used more intensively. Instead of owning the product the users have access to the product when it is needed. Compared to the individual product ownership, the sharing of the product may entail the use of fewer resources as fewer products have to be produced to satisfy the consumers' demand for the product. In that way, the model may have environmental benefits as well.

There is a variety of different product sharing models, such as car-sharing, car-pooling, sharing of holiday houses (time sharing) and sharing of computers/server access through cloud computing (remote provision of computer services and storage capacity also known as telecomputing). These sharing models have in common that the consumer does not pay for buying a product but only for using it. The advantages of such sharing models depend on how often the product is used, and whether there is a need for changes of the product's function (e.g. car-sharing where the user gets access to a fleet of different cars that can match her needs). The need for the product is also important. If the user needs a car on a daily basis, car-sharing may not be the proper solution for her transport demand.

Car-sharing is the type of sharing models that has been investigated the most with respect to the model's environmental and economic impact. The organised sharing of cars is one of the areas where new ways of sharing products has entailed the largest environmental benefits. Move About is a Norwegian car-sharing organisation where members have access to a fleet of electric cars. The company has an expected turnover for 2010 of EUR 6 million, and envisages a large growth in the coming years, cf. Box 3.5.1.

**Box 3.5.1** Case study: Move About

The Norwegian mobility service company Move About established a car sharing business for electric cars in 2008. Since then the company has experienced strong growth. Move About - which operates in Norway, Sweden and Denmark - has grown from an annual turnover of EUR 150 000 in 2008 to an expected turnover of EUR 6 million in 2010.

The majority of the company's 1 000 customers are enterprises. Move About delivers the cars, the insurance, the reservation portal, washing and cleaning and a complete mobility service package. There is a fixed price for the service each month whatever the use of the car.

The attraction of the corporate customers is the economic advantage of sharing the cars. The booking system of Move About allows the companies to cover the mobility requirements for 20 - 30 people for each car in the fleet. Furthermore, in Norway the electric cars are exempted from parking fees, free of congestion charges and they are entitled to use the bus lanes. Several corporate customers stress the branding value of driving electric cars sending a signal of corporate environmental responsibility.

Move About is planning to expand their services. The target is 6 000 customers in 2011, growing to 15 000 customers in 2014. Move About estimates that the potential of car sharing is 10-14 pct. of the population in Europe.

Another example of a sharing business model is GreenQloud. GreenQloud is an Icelandic company that provides cloud computing based on 100 pct. renewable energy. Users share access to the same servers and computational power and save high expenditures on buying hardware and software themselves. There is an increasing global demand on cloud computing from companies as well as from individuals. The case is further described in Box 3.5.2.

**Box 3.5.2** Case study: GreenQloud

The Icelandic company GreenQloud is specialized in public cloud computing services for companies and individuals based on the excessive green energy available in Iceland.

Cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services). Customers replace fixed capital expenditures and risks on buying computer hardware and software by varying costs according to their current needs.

There is a global tendency for using cloud computing. The ever increasing demand for using the newest technology, the fastest computers and the best software and the increasing need for more computer power have made the use of cloud computing popular worldwide. Today, cloud computing is an important integrated element in the development of new hardware and software.

Cloud computing consumes a lot of energy in order to keep all the computers and servers running. But according to GreenQloud, almost no cloud providers today are considering using renewable energy. Therefore, GreenQloud aims at being first movers on providing this service as 100 pct. green.

There is a rising interest and consumer pressure for green cloud providers. Even before the launch of GreenQloud in December 2010 they are getting a lot of interest and many beforehand registrations.

## Market potential

Product sharing constitutes new market potentials for companies. The sharing of products gives the customer access to products of a higher quality and a larger selection of products and services compared to private product ownership. The Norwegian car-sharing organisation Bilkollektivet, a case which has been analysed in this project, gives the members access to a fleet of different types of vehicles that allows the user a higher flexibility than private car ownership. Through mobility services, the customers get access to electric cars that they otherwise might be reluctant to purchase due to high initial investment costs and uncertainties of performance. The case company GreenQloud's cloud computing services also provides the consumer with higher flexibility than private ownership, as the customer on an ongoing basis gets access to the most advanced technology (e.g. networks, servers, storage, and applications). Companies that use sharing business models substitute the range of shared products with a higher frequency than private product owners. By using the newest technology it is possible continuously to reap the benefits of new innovations such as improved performance and lower energy consumption.

The case company Kuinoma sees a great potential for a wider use of similar sharing schemes in other Nordic countries. For a number of products sharing constitutes a potential for consumers to try out new and expensive products before purchasing them. The sharing business model thereby can contribute to pave the way for new markets of products where the customers are hesitant to purchase products due to high initial costs and uncertainties of the product's performance.

The total market potential for shared product models in the Nordic countries has not been estimated. The companies and expert of the field in this project estimate a large untapped potential for a number of these models in the Nordic region. Though, the potential depends widely on the type of product that is shared. Car-sharing organisations in the Nordic countries also see a large untapped potential for disseminating their business model. In a Swiss study the economic cost saving potential related to car-sharing was estimated to be around EUR 1 500-3 100 annually per person<sup>24, 25</sup>. This will resemble a potential saving of EUR 400-800 million in the Nordic countries. It should be noted that car-sharing may not be possible for all commuters. Further, commuting needs and structure may differ from country to country.

<sup>24</sup> These figures are based upon the use of cars for only 25 percent of all trips and public transportation for the remaining 75 percent.

<sup>25</sup> Belz, F. (2001): "Mobility Car Sharing – Successful Marketing of Eco-Efficient Services", Research report at the University of St-Gallen.

## Economic and environmental benefits

For customers shared business models constitute an advantage, as the customers do not have to make the initial investments to purchase the product and the customers do not have the liabilities and risks associated with owning the product. Moreover, the customer can up- or downscale her use of the shared products and services according to her needs. Product sharing allows the consumer to save money compared to private ownership.

The case company Bilkollektivet estimates that its members save up to EUR 2500 annually by using the company's mobility services. New market opportunities arise where the products and services best matches the customer's needs, and where economic savings can be realised. The remote provision of cloud computing allows the case company GreenQloud to be situated in Iceland with good conditions for cloud computing. Electricity prices are relative low in Iceland, the energy comes from renewable sources, there are multiple high-speed fibre connections to both North America and Europe, and the stable temperature on Iceland is important to ensure the best environment for data centres.

The environmental benefits come from a reduced use of resources and reduced pollution. Shared products of higher quality last longer and entail a reduced need for virgin resources. More energy efficient products consume less energy throughout their life span. For car-sharing an important part of the potential environmental benefits comes from changes in the consumers transport habits. A number of studies show that the users of car-sharing use public transport instead of privat car driving to cover the majority of their transport needs. The case company Move About's use of electric cars in Norway entails significant reductions in CO2 emissions as the electricity comes from renewable sources. Further, electric cars do not contribute to air pollution which contributes to improve health conditions in cities.

The environmental benefits associated with shared product models depend widely on the way that the products are used. Sharing of products may entail negative environmental impacts, if the access to a shared products increases the customers use of the product (e.g. by car-sharing members getting access to a car they otherwise would not have had access to), or if the fuel consumption needed to pick up the shared item exceeds the environmental benefits gained from the product sharing.

Box 3.5.3 lists the most important economical and environmental benefits identified in this project.

**Box 3.5.3** Economic and environmental benefits in Sharing

Economic benefits	Environmental benefits
<ul style="list-style-type: none"> <li>• The consumer has no initial costs to purchase the product and no maintenance costs</li> <li>• New market opportunities for high quality products</li> <li>• Increased innovation from new markets</li> </ul>	<ul style="list-style-type: none"> <li>• Reduced use from sharing items rather than owning the items e.g. car sharing</li> <li>• Reduced use of resources and less pollution.</li> <li>• Strong incentive to design the product to withstand impacts from multiple users, improve durability and make remanufacturing possible</li> <li>• Reduction of products and of need for virgin resources due to higher quality and longer product lifetime</li> <li>• Improved city environment (less waste, less pollution, improved health)</li> </ul>

**Barriers and drivers**

The companies participating in this study points out financing as one of the biggest barrier for implementing the sharing of products. Also regulation, e.g. unclear taxation rules for the income generated by sharing of private products, is an important barrier.

Unclear economic benefits are also seen as an important barrier; the consumers often lack knowledge of the real costs of owning products, and therefore do not realize the real economic advantages of using shared products. Also, if product manufacturers are not directly involved in the development of the sharing business model they do not have incentives to design their products to be shared.

Furthermore, consumer's unwillingness to share items is a barrier. Consumers may prefer to own the products, and product owners may not want to share the products they own. For a lot of car owners for example the status related to owning a car is very important. For shared product models to be successful convenience is also crucial. Local alternatives to private owned product must be available, and hence, it is a barrier if the consumer has to use time (and fuel) to pick up the product.

Specifically, for car-sharing a particular barrier relates to urban planning. Car-sharing is not considered adequately in urban planning with respect to the integration between car-sharing and public transport, and better parking facilities for car-sharing would make car-sharing more attractive.

There are also some strong drivers for sharing of products. The consumer can save money and avoid the risks and uncertainties affiliated with ownership of products. For both product provider and the customer the positive environmental benefits derived from the sharing of products is an attractive spill-over from sharing products.

The most important barriers and drivers identified in this project are listed in Box 3.5.4.

**Box 3.5.4** Barriers and drivers for Sharing

Barriers	Drivers
<ul style="list-style-type: none"> <li>• Lack of financing. Unclear or lack of regulation e.g. unclear taxation rules for sharing of personal items</li> <li>• Lack of knowledge and uncertainty about economic benefits and real costs involved</li> <li>• Lack of availability or local alternatives. Too few sharing options close to the consumer.</li> <li>• Preference of ownership e.g. status as car owners, and unwillingness towards sharing personal items.</li> <li>• Lack of incentives for product manufacturers to manufacture products that are designed to be shared, e.g. lacks of incentives to provide energy efficient products</li> </ul>	<p>Consumers</p> <ul style="list-style-type: none"> <li>• No unforeseen costs</li> <li>• Fewer considerations regarding buying a new product</li> <li>• Savings</li> </ul> <p>Suppliers</p> <ul style="list-style-type: none"> <li>• Earnings</li> </ul> <p>Consumers and suppliers</p> <ul style="list-style-type: none"> <li>• Regulation, tax exemption</li> <li>• Positive environmental effects</li> <li>• Branding and reputation</li> </ul>

**Recommendations and initiatives**

The experts and companies involved in the project point at a range of initiatives that can contribute to the dissemination of shared product models. In general, the tax relief structure could be changed so it becomes attractive to commute in shared vehicles, and clearer regulation of income from sharing items would promote private product sharing. Product sharing can also be promoted by dissemination of information on lessons learned and economic and environmental benefits from sharing business models. Further, new business opportunities for the use of shared business models should be investigated.

Concrete, for car-sharing organisations the integration of car-sharing with public transport, and the establishing of car-sharing parking lots near public transit points are of key importance to make car-sharing attractive. The use of cloud computing can be supported by establishing better network systems. Tax exemptions on green companies will support the spread of cloud computing, and for car sharing organisations successful use of electric cars depends heavily on strong governmental support to electric cars, such as tax break and VAT exemptions on electric cars, free parking for electric cars, etc.

The most important recommendations from companies and experts in the project with regard to disseminating Sharing model are summarized in Box 3.5.5.

**Box 3.5.5** Companies and experts recommendations regarding Sharing

- A better integration of sharing models with traditional public planning like integration of car-sharing and public transport
- Improve infrastructure for sharing
- Provide more information on lessons learned and economic and environmental benefits
- Identify new ways of using the sharing model
- Better and clear regulation like tax exemption

## 3.6 Other green business models

Besides the different business models that have been described in details in the above, there are several other interesting emerging green business models. Some of the more interesting are Cradle to Cradle (C2C), Sustainable Supply Chain Management (SSCM) and Industrial Symbiosis (IS) described briefly below

### **Cradle to cradle (C2C)**

Cradle to cradle (C2C) is at its core a holistic design and production paradigm striving for a society that produces no waste and recycles everything. But it is also a green business model that stimulates innovation through the development of new products with a competitive edge.

The cradle to cradle concept is based on a bio-inspired approach to the design of products and systems where nature is seen as a closed loop production system with solar energy as the only external input. The vision of the concept is to shift from traditional sustainability looking to minimize the negative environmental impact<sup>26</sup> to strive for a positive environmental impact. The cradle to cradle idea was formulated by the German chemist Michael Braungart and the American architect William McDonough in the 1980's. Box 3.6.1. describes the core principles of their theory.

<sup>26</sup> A positive impact can be reached through integrating multi-functionality in the design that handles environmental or social issues. It can also be reached through the altering of production or of the 'end of use'-period handling so that the process creates positive CO2 footprints.

**Box 3.6.1** Principles of the model

Two of the core principles of the cradle to cradle theory are that waste represents a cost in production which has no value to the customer and that waste equals food. This means that waste should be avoided or if possible be reused as a production input or nutrient.

The model sees all materials used in industrial and/or commercial processes as “technical” or “biological” nutrients. Technical nutrients are synthetic materials that can be used in continuous cycles and have no negative environmental effects. Instead of being “downcycled” into products of a lesser value, these materials can be used over and over again. Biological nutrients are organic materials which, can be disposed of in any natural environment and decompose, providing nutrients for the soil.

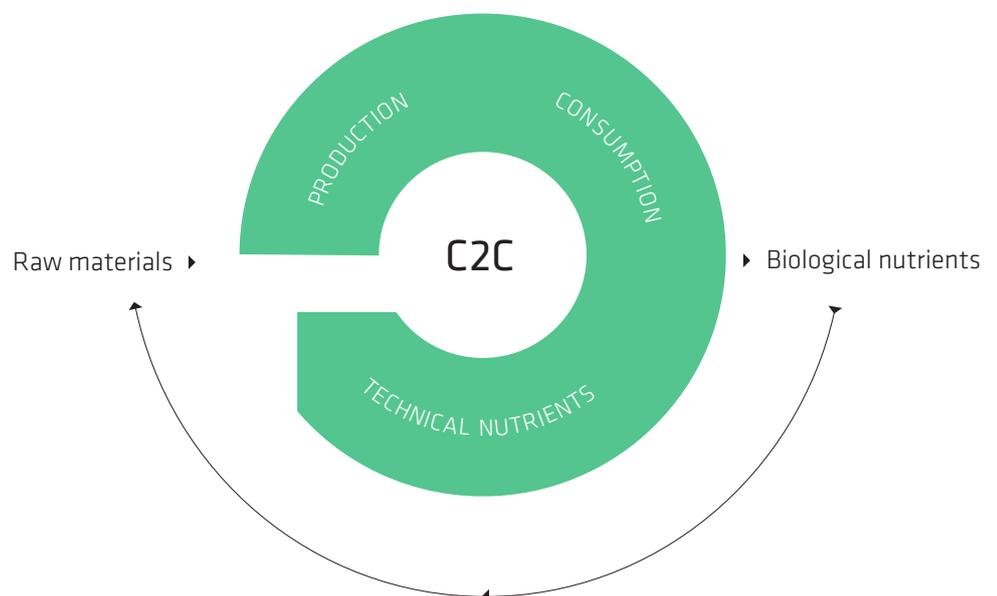
The model simply calls for designing industrial systems to be commercially productive, socially beneficial, and ecologically intelligent.

**Source** Braungart, M. & McDonough, W. (2002): “Cradle to Cradle: Remaking the way we make things” and McDonough, W., et.al. (2003): “Applying the principals of green engineering to cradle-to-cradle design”

In the cradle to cradle business model the supplier commits to extent his responsibility of the product when it is no longer in use. Thus, the supplier has the incentive to design and produce his products in a way that allows them to be disassembled and reused either as technical or biological nutrients. This has great influence on the design of the business model, since the company needs to have insight into the “up-stream” input of resources and the “down-stream” use of its products.

Figure 3.6.1 illustrates how products when they are consumed are either turned into technical nutrients that re-enters the production cycle or biological nutrients which are returned into the ecosystem.

**Figure 3.6.1** Cradle to cradle life cycle



Many see the cradle to cradle model as a rather utopian paradigm most likely because the ideal situation that the vision aims at is so far from the present situation. But the high ambitions on the vision side creates the necessary push for innovation and development of products and businesses and thus cradle to cradle contains very important ideas and elements which can be implemented in various ways into green business models. Box 3.6.2 illustrates a company that has included cradle to cradle elements into their business model. Whether or not the model is successful has yet to show.

### **Box 3.6.2 Schüco**

The German window manufacturer Schüco is currently developing a new business model in which the company no longer sells windows but rather sells a lease-like “see through” insurance for the benefit of both customer and producer. With this business model Schüco ensures customers the best and most optimal window solution now and in the future.

In Schüco's business model, the customer owns the rights to the windows, while Schüco owns the materials. And when it will be economically reasonable to upgrade or replace the windows it will be done. By that the customer is guaranteed the latest in window technology e.g. embedded solar technology etc. At the same time Schüco get their materials back and are able to reuse them in the next generation of windows. And even more important they change the relationship with the client from a one time contact to a steady contract rooted relation that offers opportunities for re- and cross sales across Schücos product portfolio.

In addition, Schüco has made an effort to optimize their materials environmental characteristics in order to secure a material cycle where “waste equals food” so that used windows can be used for production of the next generation of windows. In this way, Schüco started a process that will ensure a sound material cycle to the benefit of customers and its affiliation with the company while saving Schüco a lot of energy and money through the recirculation of its materials.

**Source** [www.vuggetilvugge.dk](http://www.vuggetilvugge.dk)

## **Economic and environmental benefits**

The Nordic companies in general are already to a high degree focusing on the full life cycle and environmental aspects of their products and services and they are working more or less consciously with some of the underlying principles. In Denmark for example the concept has generated a lot of interest both amongst environmentalists, designers, product developers and also at top management level, and elements of the mindset are starting to see its way through in product design and development. For many Nordic companies it could be a natural step to take further steps according to the cradle-to-cradle model. And because it combines innovation, product and business development with the creation of environmental benefits, it is a concept that supports a range of priority issues for the companies.

## Drivers and barriers

The key drivers for working with cradle to cradle are innovation and business development. Furthermore, implementing cradle to cradle principles can lead to reduced production costs through resource efficiency and reduces waste management costs. Other benefits are a more green image, fewer restrictions on location due to reduced environmental impact, no resource scarcity and safety issues. Another very valuable driver is that cradle to cradle has shown to increase the employer satisfaction and thereby also making it easier to attract and maintain the best employees. But companies that are working with cradle to cradle might experience increased development and production cost, increased scrutiny from customers and NGOs, lack of competencies in R&D, lack of knowledge on possibilities in upper management, insufficient reference cases, customer insecurity and lack of market-pull.

## Recommendations

More work and experiences need to be done with the implementation of cradle to cradle principles in business models and more business cases need to be documented. There is a need for showing, that it is not an 'all or nothing'-approach, but rather an inspiration for including elements into the existing business models. It is taking the initial steps towards the ideal. For many companies and organisations cradle to cradle sounds like added costs and no reward. They lack the knowledge and competencies to redesign their products and services in a way that will dramatically reduce their environmental impact and, at the same time bring economic benefits to both the producer and the end-user. But most importantly, companies and organisations need knowledge on materials, processes and their interconnectedness. Furthermore, it is important that there is a market pull for cradle to cradle products. Work needs to be done on how to stimulate this from a policy making standpoint.

## Sustainable supply chain management (SSCM)

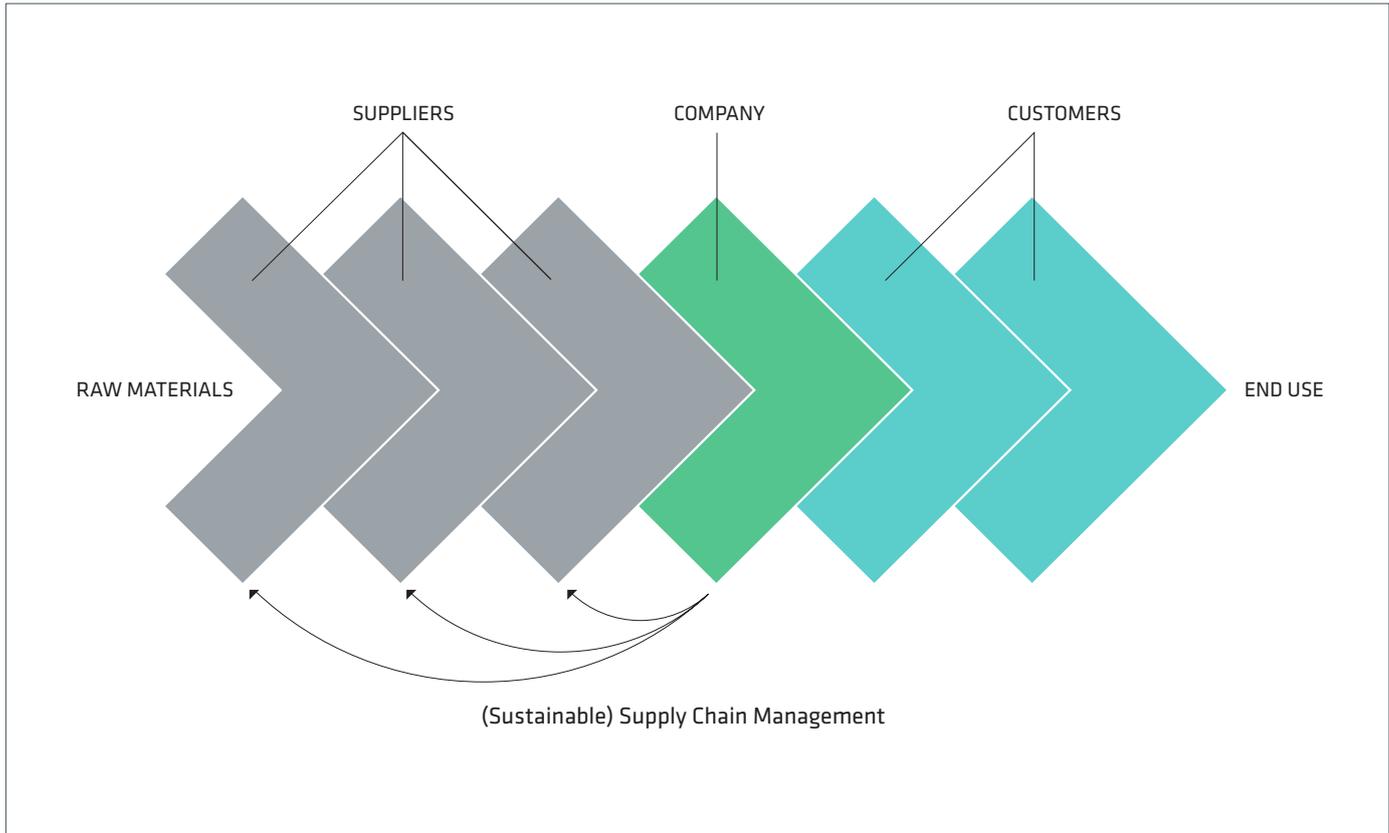
Supply chain management (SCM) is the individual company's systematic and strategic coordination of activities in the entire supply chain that is the coordination of the flows of products, services, information etc. from an upstream source of raw material to downstream customer consumption. The purpose is to improve the performance of both the individual company and the supply chain as a whole through efficiency and focus on customer requirements.

In today's business environment it is essential, that business leaders are aware of the risks represented by their companies' suppliers in terms of both late deliveries, substandard product quality etc., but also with regards to company and product image, consumer boycotts and law suits. Sustainable Supply Chain Management (SSCM)<sup>27</sup> takes of these risks with a focus on sustainability – both environmentally and socially. If fully implemented, SSCM will affect not only the end product, but all processes and input of raw materials up-stream in the supply and value chain. There is a clear link between supply chain management and environmental performance.<sup>28</sup> The concept is illustrated in figure 3.6.2.

<sup>27</sup> Accenture (2008): "Sustainable Supply Chain Management - A tool for reinforcing shareholder value"

<sup>28</sup> Florida, R (1996): "Lean and Green: The Move to Environmentally Conscious Manufacturing"

**Figure 3.6.2** Sustainable Supply Chain Management



Sustainability is becoming an increasingly important concept for companies, as social and environmental issues are becoming more and more inseparable from the companies' economic success. Today, companies are not only responsible for what happens inside the company but also what happens in their supply chain following the logic that if the input is not sustainable, the output cannot be either. Thus, it is increasingly important for companies to manage their supply chain from a sustainability standpoint.

**Box 3.6.3** Case study: IKEA IWAY

The IKEA Way on Purchasing Home Furnishing Products (IWAY) is a code of conduct that helps define the company's relations with its suppliers. It is based on the eight core conventions defined in the Fundamental Principles of Rights at Work, ILO declaration June 1998 and the Rio Declaration on sustainable Development 1992. IWAY covers IKEA's minimum requirements in the following three areas; outside environment, social and working conditions (including child labour) and wooden merchandise.

IWAY specifies IKEA's minimum requirements for suppliers and what they can expect from IKEA. Suppliers are responsible for communicating the content of the IKEA code of conduct to co-workers and sub-contractors and ensuring that all measures required are implemented. Since 2006, the IWAY requirements also include that suppliers must conduct their own audits and have a health and safety committee with half its members being employees. This is in line with IKEA supporting and motivating the suppliers themselves to implement and maintain the requirements stated in IWAY.

In order to ensure compliance with IWAY, IKEA conducts unannounced audits or inspections to verify that the IWAY requirements are fulfilled. Audits are executed by internal and external auditors using detailed checklists for different categories

**Source** Accenture (2008): "Sustainable Supply Chain Management - A tool for reinforcing shareholder value" and [www.ikea.com/ms/da\\_DK/about\\_ikea/pdf/SCGlobal\\_IWAYSTDVers4.pdf](http://www.ikea.com/ms/da_DK/about_ikea/pdf/SCGlobal_IWAYSTDVers4.pdf)

In addition, Sustainable Supply Chain Management increases leadership focus on the utilization of inputs such as raw materials, energy, water etc. This provides important knowledge on where in the production process the use of these factors can be reduced or substituted with more environment friendly inputs. This has potentially both environmental and economic benefits.

**Economic and environmental benefits**

The increased public focus on environmental and social sustainability ensures that more and more companies focus on these aspects in supply chain management, partly because it is effective supply chain management and partly because they are afraid of bad publicity. The primary potential is environmental. The additional economic potential will be limited due to the fact that many companies already work with Supply Chain Management.

**Barriers and drivers**

Companies have an interest in SSCM for various reasons. Firstly, most companies work with supply chain management, and therefore it is a natural step to work with suppliers on sustainability aspects. This will reduce input costs through tighter management of e.g. energy and water resources, risks related to public scrutiny and enhanced the company and product image. In addition it will also lead to a deeper knowledge of production flows and integration with suppliers and customers. This on the other hand also represents a barrier since it enhances the costs related to substitution of suppliers. Other barriers include lack of competencies and knowledge on supply chain management and sustainability issues. Lastly, the lack of purchasing power or size represents a barrier to companies when trying to influence suppliers. Smaller customers simply haven't got the strength to make the suppliers change their products and production processes.

## Recommendations

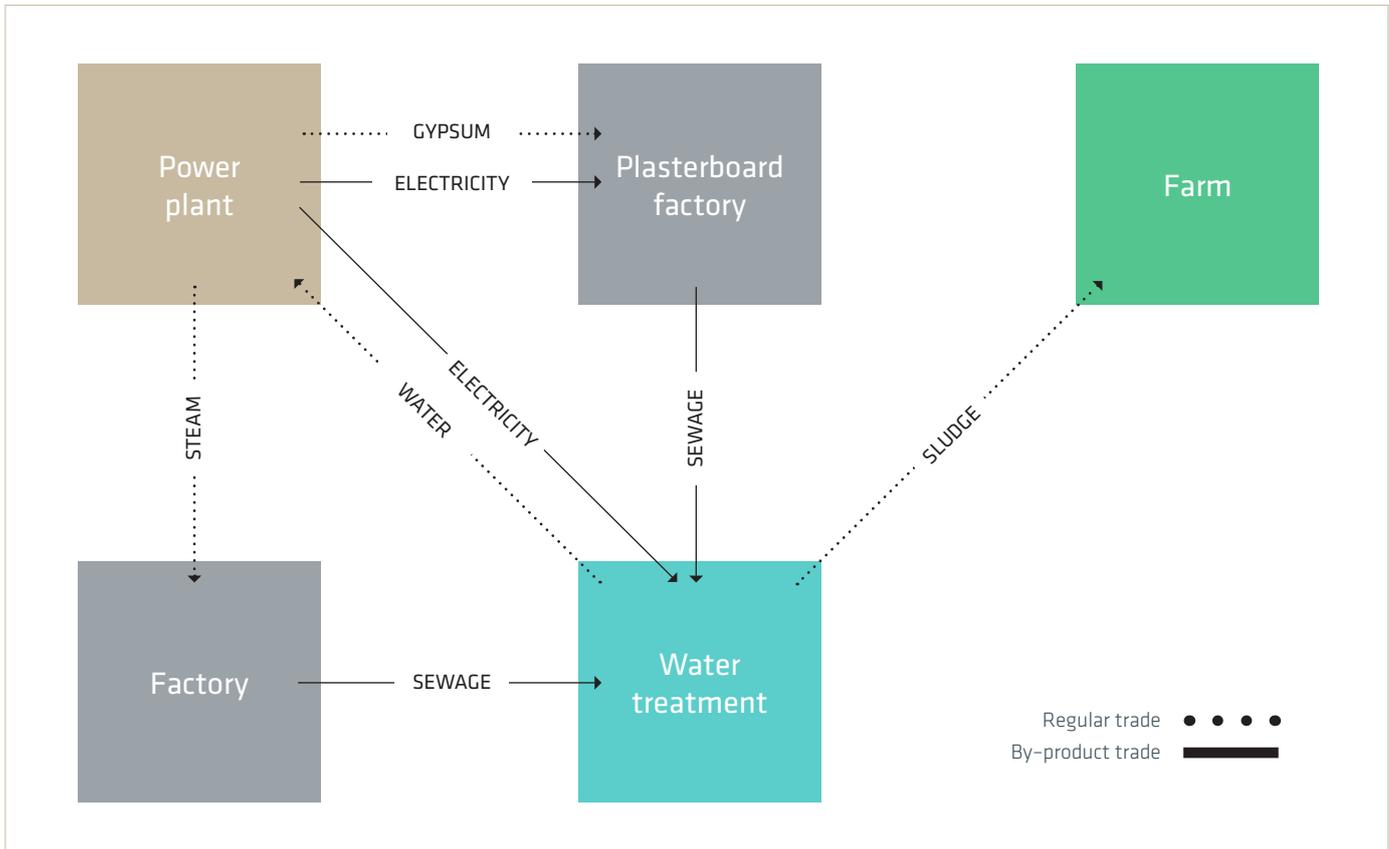
Supply Chain Management and Sustainable Supply Chain Management are widely described and utilized across industries. But it is still a challenge to many SMEs. More work should be done on how to make sure that Sustainable Supply Chain Management is an attractive option for SMEs.

## Industrial Symbiosis (IS)

The core of Industrial symbiosis is a shared utilization of resources and by-products among industrial actors on a commercial basis through interfirm recycling linkages. The aim of industrial symbioses is to reduce costs and environmental impact of participating companies and municipalities. In industrial symbiosis traditionally separated industries engage in an exchange of materials and energy through shared facilities. The waste of one company becomes another’s raw material. The benefits for the public partners are primarily reduced waste management costs. Both substantial and minor environmental benefits accrue from these industrial symbiosis exchanges.<sup>29</sup> See figure 3.6.3 for an illustration of industrial symbiosis.

<sup>29</sup> Jacobsen, N.B. (2006): "Industrial Symbiosis in Kalundborg, Denmark: A Quantitative Assessment of Economic and Environmental Aspects".

**Figure 3.6.3** Industrial Symbiosis



In Industrial symbiosis the different companies in the symbiosis do not necessarily do business with each other. There is no ordinary customer supplier relationship which brings the companies together - as was the case in Sustainable Supply Chain Management (see above).

In an industrial symbiosis companies get access to cheaper and/or more environment friendly raw material and energy input which to other companies represent waste. The company which supplies the raw materials and energy reduces the cost of waste management and in some cases turn it into profit. The economic motivation, however, is often connected to upstream or downstream operational performance and not directly associated with the value of the exchanged by-product or waste itself.<sup>30</sup> The benefits to the public actors are reduced environmental externalities and waste management costs.

<sup>30</sup> See previous note

#### **Box 3.6.4** The Industrial Symbiosis in Kalundborg, Denmark

The Industrial Symbiosis of Kalundborg in Denmark is built as a network co-operation between the seven companies and the Municipality of Kalundborg's technical departments. The philosophy behind the Symbiosis is that the seven companies: DONG Energy Asnæs Power Station, the plasterboard factory Gyproc A/S, the pharmaceutical plant Novo Nordisk A/S, the enzyme producer Novozymes A/S, the oil refinery Statoil A/S, RGS 90 A/S as well as the waste company Kara/Noveren I/S and Kalundborg Municipality - exploit each other's residual or by-products on a commercial basis.

A concrete example is that more than 98 pct. of the sulphur in the flue gas from the Asnæs Power Station is removed in the desulphurisation process. The by-product industrial gypsum is produced by adding calcium and recycled treated waste water. Industrial gypsum is utilised by the plasterboard manufacturer Gyproc A/S and replaces imported natural gypsum.

**Source** [www.symbiosis.dk](http://www.symbiosis.dk)

In Industrial Symbiosis, companies collectively build and strengthen their competitive advantages through collaboration and synergies offered by geographic proximity.

### **Economic and environmental benefits**

It is difficult to assess the real potential for Industrial Symbiosis in the Nordic countries. The potential of large scale Industrial symbiosis like in Kalundborg is limited, but the scale can also be smaller. In principle it only takes two companies to create a symbiotic partnership or collaboration E.g. if a shop utilizes the excess heat from the bakery next door for heating. Here the potential for Industrial symbiosis is huge. When companies engage in symbiotic cooperation, they get access to cheaper inputs and reduce their waste management costs strengthening their competitiveness. In addition, they create a demand for technologies and systems that enable the exchange of materials, energy and knowledge. Thus a new market with a global export potential is created.

## **Barriers and drivers**

If companies are part of an Industrial symbioses, they can reduce their costs on the input side. They get access to e.g. cheaper raw materials, energy and water. On the output side they reduce their waste-management costs, by utilizing parts of their waste and by-products. Furthermore there are environmental benefits, which both result in lower environmental taxes and costs and can be used as a marketing platform. On the other hand, there is a need for substantial investments in materials and energy infrastructure systems within the Industrial symbiosis. This means, that the Industrial symbiosis is not a very flexible system, and puts a great demand on trust among the different actors, since they are bound together through their joint investments. Finally lack of knowledge can be a considerable barrier to both companies and public authorities.

## **Recommendations**

There is a need for more experiences and case examples on Industrial symbiosis. More work need to be done on potentials and barriers for companies and public authorities' engagement in Industrial symbiosis - both on a large scale as with the Kalundborg case and in small scale with fewer involved actors.

## 4. Annex

The following material along with this Green Paper can be downloaded at the website of the Nordic Council of Ministers ([www.norden.org](http://www.norden.org)), The Danish Enterprise and Construction Authority ([www.ebst.dk](http://www.ebst.dk)), and FORA ([www.foranet.dk](http://www.foranet.dk)).

- Delimitation of the scope of the project
- Working paper
- Contact information on case companies and experts interviewed
- Collection of 25 cases and 5 expert interviews - reports
- List of the project's working group participants
- List of participants at workshop
- Workshop programme
- Points for discussions and questions for the workshop
- Presentations from the workshop
- Identified companies, experts and authorities working with green business models
- Policy briefs
- Tables from a quantitative company survey

**FORA**  
Dahlerups Pakhus  
Langelinie Allé 17  
DK - 2100 Copenhagen  
Denmark

+45 35466320  
fora@ebst.dk  
[www.foranet.dk](http://www.foranet.dk)