

Good examples:

Case studies within applied life cycle thinking

The project “Good examples – Inspiration for energy efficiency through the entire value chain”, which was carried out by Swedish Life Cycle Center with funding from the Swedish Energy Agency, includes interviews with representatives from different organizations working with an applied life cycle thinking. The aim was to gain knowledge of different methods and ways of working on life cycle related issues in different types of organizations. Organizations are selected to represent different sectors, and to demonstrate a variety of approaches to life cycle issues.

The results from case studies have been highlighted through interviews presented as articles. The purpose of the articles has been to present the result in a communicative and educational manner, from different types of organizations about their work, to share their tips on how to start apply a life cycle thinking and to inspire other organizations to work with a life cycle perspective.



Life cycle perspective from a consumer point of view

- The City of Gothenburg's work to reduce its public-sector consumption

This example from the City of Gothenburg shows how the life cycle perspective can be used from a consumer perspective to help make climate-smart decisions regarding consumption in public-sector companies and authorities.

The City of Gothenburg joined forces with SP Technical Research Institute of Sweden – to create a tool that can compare the carbon footprint of various meals. With this as a guide, municipal employees can make more climate-smart choices in public-sector consumption and thereby reduce the city's carbon footprint.

The food we consume accounts for a third of our global climate impact and is linked to several key environmental issues. This means that smart choices in the food we eat can make a significant difference.

1. City of Gothenburg 2016: /Miljö och klimat /Det gör Göteborgs stad/Miljömåttider (Downloaded in August 2016)

As home to half a million people, the City of Gothenburg is Sweden's second-largest city. With 52,000 employees and an annual turnover of SEK 34 billion, the city's public companies and authorities also constitute a major consumer. This has also become an important starting point in the environmental work of the City of Gothenburg. The city's politicians have decided that the city will focus on sustainable food. By applying the life cycle perspective from a consumer angle, the city can make a considerable difference and set an inspiring example. The life cycle perspective is used as a method of reducing public-sector consumption.

To find out more about the City of Gothenburg's application of the life cycle perspective, we interviewed Ulla Lundgren, Process Manager for Sustainable Meals at the Environmental Administration of the City of Gothenburg.

How does the City of Gothenburg apply the life cycle perspective?

- We are currently applying this perspective in two ways:

One is directly in our activities, within the meals organisation, with a type of climate module in the food planning system, in which the people who plan the menus can see what happens when they replace one food with another. They receive data showing the carbon footprint per lunch expressed as kilograms of carbon dioxide equivalents (kg CO₂e).

The other way is that we monitor the entire city's climate impact from food via the city's purchasing statistics using a tool called Klimatkompassen (the Climate Compass).

The City of Gothenburg must also produce life cycle data for all purchases that it makes; for example, a major project is now under way to obtain life cycle data for construction materials, a sector in which about 75% of purchases are made outside of agreements.

How has the life cycle perspective advanced environmental issues?

- Within the framework of developing the city's local food strategy, we will investigate needs and opportunities for obtaining additional parameters for the life cycle perspective concerning the actual environmental and climate impact of the food, so that we can perform suitable assessments of which foods are best to procure and serve from a sustainability perspective.

What is the most important thing about working with a life cycle perspective?

- It is important in terms of reducing the negative environmental and climate impact that is associated with a large city's consumption. As food accounts for 25% of total consumption-driven climate impact in Sweden, it is an important tool with which to facilitate climate-smart choices in kitchens and the city's restaurants. Results have

“It is important in terms of reducing the negative environmental and climate impact that is related to a large city's consumption.”

been consciously improved since the city began monitoring the proportion of organic food in public-sector kitchens. The figure is currently about 25%. This surge in organic food is one factor that has encouraged better monitoring of the climate aspect.

What have been the biggest challenges in applying the life cycle perspective?

- The meals organisation at the City of Gothenburg is divided into 10 city districts, the Administration for Upper Secondary Schools and Adult Education and the Administration for Allocation of Social Welfare. That's a total of 12 different meal organisations that all have to work in the same way even though they have different conditions.

The biggest challenge regarding the climate module in the food planning system is therefore to ensure that everyone uses it. It also took a long time to input data into the climate module, and a great deal of manual work was required.

It is also very time consuming to input all foods into the Climate Compass in order to measure the city's total carbon footprint.

Do you have a concrete example of a change that has led to reduced environmental impact thanks to your life cycle perspective?

- Both yes and no, because the city decided back in 2011 that all meat that the municipality procures and serves must be organic; this led to a drop of about 8% in meat consumption from 2014–2015. The change also involves creating awareness of the issue. The climate module tells us the climate impact created by a lunch in 2010.

What is the reason for applying a life cycle perspective in this example?

- The City of Gothenburg aims to achieve a 40% reduction of its food-related climate impact by 2030 compared to levels in 2010.

“...it should be easy to do things right.”

Who initiated the use of life cycle perspectives in the example?

- SP Food and Bioscience and Region Västra Götaland initiated the development of the climate module by launching a project with co-financiers within the municipality, region and county council and the developers of the meal planning tools, Aivo, FoodIT and Mashie.

What parties have been involved in this example?

- SP Food and Bioscience, the City of Gothenburg and Aivo have been involved.

Why is this a good and inspiring example?

- It is a tool that the meal organisation can use and influence per unit, per kitchen and per lunch – it should be easy to do things right. It also highlights the issue for the people eating the food, managers and politicians.

What would you describe as the biggest motivators for you to intensify your life cycle approach?

- The biggest motivator for us to intensify our life cycle approach has consisted of the city's climate objectives regarding the aim to reduce consumption-driven environmental and climate impact.

What tips would you give to others who want to launch or further develop their own efforts to reduce the climate and environmental impact in their organisation?

- It is important to cooperate with various professions so that different aspects are addressed.

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Interview 16 November 2016, text and layout: Rebecka Hallén Jorquera, project manager, Swedish Life Cycle Center

This article is part of the project titled: Goda exempel – Inspiration till energieffektivisering genom hela värdekedjan (Good examples – Inspiration for energy efficiency through the entire value chain), which was carried out with funding from the Swedish Energy Agency. You can find out about additional examples of applied life cycle thinking, read more about the City of Gothenburg's climate work or learn more about the life cycle perspective via these links:

[The City of Gothenburg's work on climate change Sustainable Meals](#)
[More examples of applied life cycle thinking Swedish Life Cycle Center](#)



The life cycle approach shows indirect impact

– Löfbergs' coffee production

This example comes from Löfbergs and shows how the life cycle perspective can help a company determine where its environmental impact is the greatest. Founded in 1906, Löfbergs is still a family-run business in the coffee industry.¹

After a life cycle assessment, Löfbergs learned that their greatest environmental impact was in primary production – that is to say, the growers. Now they're carrying out development projects in the producing countries and making sure to purchase products certified under the KRAV, Fairtrade, Rainforest Alliance and UTZ labels.² In addition, Löfbergs is working to reduce the environmental impact of its own plant, through a focus on aspects like energy efficiency.

1. Löfbergs Lila AB, 2016: <https://en.lofbergs.se/about-us/> (accessed in September 2016)

2. Löfbergs Lila AB, 2016: <https://en.lofbergs.se/sustainability/> (accessed in September 2016)

Löfbergs' coffee production corresponds to about 10.5 million cups a day, and its sales amount to SEK 1.5 billion per year. The company has more than 300 employees in five countries and its core markets are Sweden, Norway, Denmark, Finland, Estonia, Latvia, Lithuania and the UK.

Löfbergs wants to take its responsibility for people and the environment through development projects in the producing countries and by purchasing certified coffee. (3) The company is certified to ISO 9001, 14001 and 22000, as well as FSSC 22000.(4) In the past, Löfbergs worked extensively on environmental improvement measures at home, but a life cycle assessment showed that they can make a huge difference through the type of coffee they purchase, and through measures in the producing countries. Eva Eriksson, sustainability manager at Löfbergs, tells us more.

How does Löfbergs apply the life cycle perspective?

- We work with the whole value chain. We like to call it working 'From bean to cup', taking responsibility for people and the environment. We really try to show consideration and think of every link in the chain. Every part of the organisation adopts a life cycle perspective; it's a part of our strategy and our vision.

How has this advanced your work?

- We focused on environmental issues at our plant even before we started thinking 'From bean to cup'. Back then, it wasn't such a concrete aspect in every part of the value chain, though it's become clearer in recent years.

What does applying a life cycle perspective mean for you?

- We've carried out a few life cycle assessments on selected products and examined the entire value chain, from cultivation to consumption. A life cycle assessment is very specific, but you can gear your thinking along the same lines without doing a complete assessment.

How long have you been applying the life cycle perspective?

- I started working here in 1988, and even then we had a strong life cycle focus. We conducted our first LCA in 1994. It was quite limited back then. We didn't include cultivation in that assessment, we simply compared different types of packaging while all the other aspects remained unchanged, so it wasn't a complete life cycle assessment. But even then we were thinking about renewables and how we could reduce our use of resources. In the past we've carried out energy assessments. We've had a strong focus on energy efficiency since 1991, when we started documenting our energy use. We established our environmental policy in 1992 and bought our first cargo container of ecological coffee way back in 1995. We launched the Fairtrade concept in 2000, and in 2011 we conducted a sustainability assessment, including all aspects of sustainability.

“Responsible customers choosing us is our greatest incentive.”

How did you come to be involved with the life cycle perspective?

- This approach is something of a tradition in the company. We like to say that responsibility has been a part of the family business right from the start. It's clear in our core values and it's included in our strategy. The idea of working from a life cycle perspective is both to conserve energy and to further reduce our environmental impact by finding where it is greatest.

What are the advantages of adopting a life cycle perspective?

- The advantages are that we attract staff, customers and consumers by demonstrating our dedication to the idea. We don't actually call it a life cycle perspective, we talk about taking responsibility, from bean to cup. Or sustain-

3. Löfbergs Lila AB, 2016: <https://en.lofbergs.se/about-us/> (accessed in September 2016)

4. Löfbergs Lila AB, 2016: <https://en.lofbergs.se/about-us/> (accessed in September 2016)

nable development – the life cycle perspective is sort of a part of that.

What do you see as the greatest incentives for enhancing your company's life cycle approach?

- Responsible customers choosing us is our greatest incentive. The fact that Löffbergs is a family business tells you that we're in it for the long term: it's easier to make decisions about investments that may not be very profitable in the short term, but that we see will be valuable down the road. What's good about conserving energy and resources is that it not only spares the environment but also saves money; that makes it easier to motivate our decisions. Sometimes an investment is costly, and it can take a while before it pays off.

Do you have an example of a life cycle based change that has led to reduced environmental impact?

- We conducted a life cycle assessment in 2010 in collaboration with three other big roasting houses in Sweden as a cross-sector comparison between instant coffee and brewed coffee, 500 g packages of vacuum-packed, roasted coffee. That's when we saw that the greatest impact, 80%, is in primary production – not our direct influence, but our indirect influence via the growers we use. That's why we make a point of buying certified products to reduce our climate impact.

“I was surprised at the comparatively low impact of our plant”

Was there anything that stood out when you conducted a life cycle assessment of the entire value chain?

- I was surprised at the comparatively low impact of our plant, our haulage operations and packaging materials, compared with primary production and consumption.

What changes have you made now that you are aware of the significant climate and environmental impact of coffee cultivation?

- In connection with the sustainability study of 2011, we decided that by 2016 all Löffbergs coffee would be certified to Krav, Fairtrade, Rainforest Alliance or UTZ, all of which focus on reducing climate and environmental impact. It's our way of ensuring the least possible negative impact.

How does your production in Sweden work?

- Since 1991, Löffbergs has worked extensively to reduce the environmental impact of its own plant. We don't use any oil to heat our facilities, only electricity from wind power, geothermal heating and district heating. When we invested in roasters with preheating, it drastically cut our energy consumption, because we could recycle the

heat from one roast to preheat the next roast. It saved time, electricity and LPG. It may be the single most energy-efficient measure we've implemented. As regards the plant, we've surveyed our energy consumption and we have measuring points in the plant to locate any leakage, high-energy-consuming equipment, or equipment that's running overnight even though it shouldn't be.

When we make new investments, we look for the solution that's gentlest on the environment, most energy efficient and resource conserving. For example, we've replaced three pumps with a single one, resulting in an energy saving of 80% (corresponding to 4 houses per year). Replacing a vacuum pump for compressed air reduced noise, saved energy and resulted in lower maintenance costs.

Who initiated the energy-efficiency measures?

- Often it's suppliers who come to us with a proposal and an estimate of how much energy and money we can save. We're very open to innovations. We were the first in Europe to install the new roaster – we were a pilot facility – and it's still fairly unique. Energy-efficiency measures are initiated by managers at the plant, who work according to our objectives, which I monitor as Sustainability Manager.

Do you feel that it takes certain knowledge from you as a customer to work with external players?

- Yes, you always have to tell them what you want to compare and where you're setting your system boundaries, and as the buyer you have to gather a lot of data. The consultants ask relevant questions to guide you in the right direction, so that's a support, but you do have to understand the information.

What tips do you have for others to get started with or further develop their own work on the life cycle perspective?

- Complete life cycle assessments are quite complicated. It's important to set up system boundaries – it doesn't have to be the whole life cycle, even if it's incredibly interesting to look at the big picture. You can do a comparative analysis between various scenarios, for example when a change is planned. You keep all the conditions the same, except for the one change you're looking into, for example in a packaging material. By getting involved in a larger context, you can join forces with other players and have a greater influence, take joint initiatives to make things happen.

Will you continue to apply the life cycle perspective?

- Absolutely, without a doubt.

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Interview 24 September 2015: Kristin Stamyr, researcher at the Royal Institute of Technology (KTH)

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This article is part of the project entitled: Good examples – Inspiration for energy efficiency through the entire value chain, which was carried out with funding from the Swedish Energy Agency. You can find out about additional examples of applied life cycle thinking, read more about Löfbergs' work on climate change or learn more about the life cycle perspective via these links:

[Löfbergs' work on climate change](#)
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[Swedish Life Cycle Center](#)



Life cycle perspective as a driving force for new business

- Kitchen renovation helps customers reduce their environmental impact at a lower cost

This example comes from Modexa, a company that works on solutions for kitchen renovations. The example shows how the life cycle perspective and results of an LCA can be used in marketing and sales to guide customers to make better decisions based on sustainability.

The life cycle assessment that Modexa requested from IVL Swedish Environmental Research Institute showed the amount of carbon dioxide that their customers avoid emitting by keeping the elements of their old kitchen that are still in good shape. Modexa used this information as a selling point when meeting with a customer that was going to renovate flats in Botkyrka just south of Stockholm, Sweden.

Modexa sells kitchen solutions. Their business concept is based on renewing kitchens by utilising the existing basic structures and adding on features such as cupboard doors, hinges, drawer systems and worktops. Modexa started in 1998 and currently has sales of about SEK 160 million per year. Its headquarters in Borås and manufacturing facility in Västerås employ 55 people, and they have at least as many local installers in Sweden's 30 biggest cities. Modexa's customers are property management companies with rental units. In 2015, Modexa discovered the concept of life cycle assessments for the first time. This led them to contract IVL to conduct an LCA on kitchen carcasses. They used the results of the assessment to show customers how they can reduce their climate impact and energy use.

We met with Mikael Larsson, Head of Sales and Marketing at Modexa, to learn more about the company and its focus on the life cycle perspective.

How does Modexa apply the life cycle perspective?

- Our entire business concept is about the life cycle perspective, because we're preserving what's good and replacing what's bad. What we didn't know before was how life cycle assessment can be used as a tool for the organisation. Our production unit is environmentally certified and we have long wanted to reflect our positive environmental aspects in our customer offering. Now we can better communicate the benefits of applying a life cycle perspective. We will continue these assessments to demonstrate to our customers how much better it is for the environment not to demolish parts of their kitchen units that still have many good years ahead of them.

How did you come to be involved with the life cycle perspective and how did you learn about it?

- Our business concept is based on demand from our customers. The company's founders started with the basic consideration: 'Why replace fixtures that can be kept, when you can create a new kitchen for tenants that is also cost-effective for the property owner?' SCA, which often does life cycle assessments, told us how they translate them into practical measures. As a result, we

contacted IVL to conduct a life cycle assessment.

What did the life cycle assessment entail, and what were the results?

- IVL did an assessment of average kitchen carcasses, produced and installed in Sweden, based on a generic Swedish apartment kitchen. The analysis included the production of raw materials and packaging materials, transport and waste management. The results showed that 75% of the climate impact of kitchen carcass comes from the raw materials. For example, you can save 80 kg of carbon dioxide per kitchen just by retaining the original cupboard carcasses. However, the total saving on the entire concept is much greater.

How did the report affect your work?

- Modexa has always worked from the assumption that it's better environmentally and financially to keep what's good and replace what's bad, but until we began measuring and attaching figures to every aspect, we didn't realise just how much better. The results of the life cycle assessment make

"Our entire business concept is about the life cycle perspective..."

it much clearer, more fun and also more useful to provide a concrete example. Because our whole business is about making use of good quality, built-on-site carcasses rather than tearing them out and replacing them with new structures that are often poorer quality, life cycle assessment helps us to show customers the environmental benefit of keeping more.

One concrete example of how we've used the results is in the sales pitch to a customer, where we can point out the environmental potential of keeping as much as possible of the original kitchen rather than buying new.

One customer that was convinced by Modexa's life cycle assessment was Botkyrkabyggen, a municipal housing company in Stockholm and Botkyrka's biggest housing

company, which owns and manages some 10,600 homes. Modexa met Botkyrkabyggen in connection with one of their ongoing pilot projects for the renovation of properties from the run-down 1960s One Million Homes programme. One of Botkyrkabyggen's goals for the renovations was to choose the best solution in terms of environment, quality and satisfied tenants who were also able to keep living in the apartments.

Can you tell us more about the Botkyrkabyggen example?

- Botkyrkabyggen had 99 flats to be renovated. While taking measurements in the kitchens, the company did a technical inspection in order to produce a specific analysis. The customer had previously drawn up specifications of what they wanted done in the kitchens. After the technical inspection, our recommendation was that they didn't need to remodel as much as they were proposing."

"We were able to show them that they would reduce their environmental footprint to a much lower cost."

What did that lead to?

- With the results of the life cycle assessment, we were able to show our customer how they could spare the environment in a big way by conserving more and replacing less. It seems somewhat counterintuitive, because you want to sell as much as possible. But I think in the long run this will lead to even more sales. When customers buy our concept, they are the ones saving money, we're just helping them. When we presented our results to our customer, they couldn't say no. We were able to show them that they would reduce their environmental footprint and to a much lower cost. There is also a social-justice dimension, as more tenants can afford to stay in the flats because the renovations are less extensive.

What other results have you seen from this example?

- Property management companies often want to save energy on operating costs, but they don't consider savings to be made on materials for the flats. As the LCA shows, raw materials make up a significant part of the climate impact of new manufacturing.

What results has this led to in your organisation?

- If we do an estimate of the 10,145 kitchens we renovated in 2015 with the figures we got from the IVL report, we've prevented over 800 tonnes of carbon dioxide emissions by keeping the existing carcasses. And those figures are about benefits outside the organisation, which I think is the coolest part. We can be as climate-efficient as possible in our own organisation, and of course we should try to do that, but the greatest saving through this method actually benefits our customers.

What parts of the company have been involved?

- The idea of ordering a life cycle assessment to spotlight environmental impact and what can be saved by renovating kitchens rather than buying new fixtures came from the marketing and sales department, so they've been heavily involved in this, as well as our management and production.

This is a central focus for us and it's now a part of our environmental management system. In 2017, the entire organisation will be given more information about the life cycle perspective and how it can be communicated. We will continue focusing on our life cycle approach; to us it's about working with our customers step-by-step to reduce carbon dioxide emissions. That's what we've focused on above all.

What are your greatest obstacles to intensifying your life cycle approach?

- The greatest obstacle has been resources and skills. We are not a giant company, and so far it's been a handful of people promoting these issues. But now we've recruited a quality manager who will take over the responsibility for LCAs in the future. And of course, in the future it will still be important for the entire organisation to focus on these issues.

What advantages are there, apart from the environmental ones, to taking a life cycle approach?

- There's a kind of internal pride in working this way. I think it feels good, and I'm convinced that many of our employees are genuinely happy to be selling these solutions. We know that we are contributing from a greater perspective.

What is your next step in your life cycle approach?

- To continue spreading the message both internally and externally about the environmental benefits of maintaining the original cupboard carcasses.

What tips do you have for others to get started with or further develop their efforts to reduce their own organisation's climate and environmental impact?

- Number one is to find people in the organisation who are passionate about these issues. It's also important to think from the outside in – how to create added value. We have no purpose if we can't help our customers achieve their goals – and not just financial ones, but also environmental goals!

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Interview 7 January 2016: Anna Wikström, Project Manager, Swedish Life Cycle Center.

*Text and layout: Anna Wikström and Rebecka Hallén Jorquera, Project Manager, Swedish Life Cycle Center
This article is part of the project entitled: Good examples – Inspiration for energy efficiency through the entire value chain, which was carried out with funding from the Swedish Energy Agency. You can find out about additional examples of applied life cycle thinking, read more about Modexa's work on climate change or learn more about the life cycle perspective via these links:*

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The life cycle perspective makes things clear

– Provides key figures, approaches and parameters

The Swedish EPA report *The Climate Impact of Consumption* shows that dairy products accounted for 17% of the climate impact of Swedish food product consumption in 2008.¹ This example comes from the company Oatly and it shows how the life cycle perspective can help an organisation to develop concrete objectives to minimise its environmental and climate impact. Using life cycle assessments, Oatly was able to locate development areas that would benefit both the company and the society as a whole.

In 2013, SP Technical Research Institute of Sweden carried out a life cycle assessment on Oatly's oat-based drink, based on the ISO 14040 standard. The results were compared with the corresponding cow's milk product and found that cow's milk had 2.6 times more climate impact than the oat drink.²

For Oatly, the assessment pointed out potentials for improvement in energy consumption. This resulted in the goal of reducing consumption by 30%, which was a positive development for the company and also reduced its environmental and climate impact.

1. Swedish Environmental Protection Agency, 2008, *The Climate Impact of Consumption*, Report: 5903

2. SIK, 2013, *LCA på färsk och aseptisk havredryck (LCA of fresh and aseptic oat drink)*, final report: PX20462

Oatly was founded in the 1990s and produces oat-based food products. At the beginning of 2015, Oatly had about 70 employees, but the number is growing rapidly. It is important to Oatly that their own production strives for minimal environmental and climate impact, and that their products are significantly better environmental choices in the supermarket than the more traditional animal-based products. Oatly is an inspiring example of the life cycle perspective, because they work actively to reduce the environmental impact of their operations and have utilised life cycle assessments to develop the necessary basic data to set up goals and implement concrete measures.

We met with Carina Tollmar, sustainability manager at Oatly, to learn more:

“By applying a life cycle perspective, we found that we needed to work most on climate impact and our water and energy use.”

- Previously we've gone on our gut instinct to find areas where we were better or poorer in terms of environmental issues, but we wanted real facts. We wanted both to compare how our oat drink compares with cow's milk, and to find areas we can further develop and improve.

The life cycle assessment that SP conducted showed that Oatly's gut feeling was accurate – producing a fresh oat-based drink has less environmental impact than the corresponding production of cow's milk. It was very clear that the oat-based product holds up well in the comparison, but it also revealed Oatly's potential for improvement.

By applying a life cycle perspective, we found that we

needed to work most on climate impact and our water and energy use. Our energy consumption was 40% of that of cow's milk, and we felt that was too much. So we had quite a bit to work on.

Why do you apply the life cycle perspective?

- Many people in the company have great dedication to environmental issues, and an environmental improvement group formed spontaneously among dedicated employees. The first time a life cycle assessment was carried out that covered the entire life cycle was in 2013, though it started in 2012. It was conducted primarily for our own benefit, to help us to set priorities for how we can improve. At the same time, the difference in environmental impact between oat drink and cow's milk began to be a common question from consumers and we could only answer that our drink most likely had less impact, but we didn't have figures for that.

Do you have an example of a life cycle-based change that has led to reduced environmental impact?

- The life cycle assessment confirmed some areas of production that we suspected could be developed, and energy use was one of them. We've begun implementing measures in that regard, and once all the new technology is installed, we will have reduced our energy use by 30% – and reduced climate impact goes hand-in-hand with that. In production, we've installed a heat pump that recycles energy, sealed off the water system better and replaced 20–25% of our use of natural gas with biogas. In the long term, a new heat-treatment machine will be installed, which will further reduce energy use.

Those are the biggest measures. We also have a smaller project that involves thermal insulation, and when we replace machines, we now choose all the accessories we can to make them more energy efficient.

Have you run into any challenges?

- We're in a huge expansion phase right now, so it's hard to get an overall view of how our energy use really looks and how it is decreasing. It's difficult to measure because it's not a static process, and right now it's going too quickly. Our planning was too restricted, so this is a difficulty in everything we're doing right now.

What have you done to meet this challenge?

- We're trying to see the big picture. When we reorganised, we formed our own team, a process improvement team that could provide technical solutions.

How do you work on sustainability in addition to the life cycle perspective?

- We work on environmental goals that we're currently further developing. We have great ambitions to further include employees and suppliers, and to develop monitoring systems. In addition we're working on external communication. We would also like to see our excess heat being used externally in some way. Even though we use it to heat our offices and warehouses, we still have a surplus.

What are the advantages of adopting a life cycle perspective?

- It clarifies things and makes them concrete. It provides key figures and helps us to develop our approaches and parameters. It showed us new areas that we didn't think were so significant, but that actually had a great influence. If you do a proper assessment, you can find alternatives right from the start.

Can you give an example of how the life cycle perspective has influenced your working methods?

- We've had interdepartmental teams, with staff from, say, production and marketing, and held discussions back and forth about various issues in the environmental sphere. That's given us a lot as an organisation, and now we want to put those words into action. It's good for a company to understand its operations, where you have hotspots and where you can implement measures. It's a combination of internal people developing data and brainstorming with external experts. The life cycle assessment was carried out by SP.

Who would you like to see influenced by your particular case story regarding the life cycle perspective?

- Above all, I think we should create a bit of inspiration in other food product companies, because that's the industry we're mainly involved with. We want to get a discussion going about the difficulties in the industry, as well as its opportunities and what can be done. But we also have a strategy of showcasing for external parties what we can do and what we have done. Our distri-

butors and consumers should see that we want to, and that we can achieve something, that we're not doing everything right, but we're constantly working to be better.

What tips do you have for others to get started on or further develop their own work with the life cycle perspective?

- Just get started! But first and foremost, you need to understand why you're doing it, that it actually can make a difference. And as always, it's important to have internal support. If you understand that you have to do this, and it's well supported in the organisation, you can trigger a lot of creativity in the company. They'll start developing ideas and holding discussions about how to work together both in-house and with the community. We deliver a by-product for pig fodder, and will, among other things, start to work together with oat growers. We need to help each other, both internally and externally.

“We want to get a discussion going about the difficulties in the industry, as well as its opportunities.”

If you know you want to make a difference and understand how that can be done, it's easy to get started. And it can't all be on one person to do everything. It's easiest to bring in external assistance to carry out the life cycle assessment. If the LCA is carried out internally, it will take resources from the company, and the person doing the work must be familiar with the methods.

Will you continue to apply a life cycle perspective?

- Absolutely!

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Interview 3 September 2015: Johanna Spångberg, researcher at the Swedish University of Agricultural Sciences (SLU).

Text and layout: Rebecka Hallén Jorquera and Anna Wikström, Project Managers; Hugo Gustafsson, communication officer; Swedish Life Cycle Center.

This article is part of the project entitled: Good examples – Inspiration for energy efficiency through the entire value chain, which was carried out with funding from the Swedish Energy Agency. You can find out about additional examples of applied life cycle thinking, read more about Oatly's work on climate change or learn more about the life cycle perspective via these links:

[Oatly's work on climate change](#)
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[Swedish Life Cycle Center](#)

The life cycle perspective – a matter of accountability

– Working on environmental issues requires knowledge from a holistic perspective

This example comes from the municipality of Sollentuna, north of Stockholm, Sweden. It shows how the life cycle perspective can help an organisation to set the right priorities in their climate and environmental work. Thanks to a life cycle assessment, the municipality was able to find new areas for improvement and optimise its priorities.

The Municipality of Sollentuna had the Swedish Defence Research Agency (FOI) conduct an overall life cycle assessment, followed by an in-depth analysis by the environmental consulting company Miljögiraff. The analyses found several areas with the potential to reduce the municipality's impact on climate and the environment. One area that the results particularly highlighted was the significant impact of the municipality's food consumption. According to the Swedish EPA, the amount of food that Swedes throw away corresponds to about 3%¹ of the nation's total emissions of greenhouse gases, and about 50% of the food waste from industrial kitchens could be avoided.²

1. Swedish EPA, 2015: <http://www.naturvardsverket.se/Miljoarbete-i-samhallat/Miljoarbete-i-Sverige/Uppdelat-efter-omrade/Avfall/Avfallsforebyggande-program/Matsvinn/> (updated 2015)

2. Swedish EPA, 2014, Food waste volumes in Sweden, 2012

Located just north of Stockholm, the Municipality of Sollentuna is home to about 70,000 people and an employer of 2,725, half of them teachers. Politicians and officials in the municipality have noted that the residents have been increasingly demanding greater emphasis on environmental and climate change issues. Due to the need to conserve resources, such as time and money, the municipality wanted to make sure to prioritise the right areas by working to identify those with the greatest potential for improvement. Sollentuna is an inspiring example, because the life cycle perspective gave the municipality good guidance in working with priorities. The life cycle assessment gave them a good overall picture of the municipality's environmental and climate impact, which they were able to translate into a priority list.

We met with Malin Möller, climate and environmental strategist in the Municipality of Sollentuna, to learn more about the municipality and its focus on the life cycle perspective.

“In terms of time, money and resources, we can't do everything at once; life cycle assessments helped us to focus our efforts in the right direction.”

How does your municipality apply the life cycle perspective?

- We started by carrying out a preliminary study on life cycle concerns in 2012, in which we evaluated our impact based on a life cycle perspective so that we could include aspects outside our direct influence. That study gave us such interesting results that we wanted to take it a step further with a more in-depth assessment, which was completed in the summer of 2014. Since then, these studies have been complemented by detailed studies at a school, a pre-school and an assisted-living facility.

How did you come to be involved with the life cycle perspective?

- Initially it was a political incentive, as the advisory council for Sweden's environmental and climate work (Sveriges miljö- och klimatberedning) began developing a climate strategy in 2010 that will affect all of the municipalities. They began by looking at climate impact and analysing it from a life cycle perspective. Some gaps were identified, and we could see that it was not enough to simply look at the impact of the municipality's own operations. We realised the necessity to study impacts from a life cycle perspective.

In addition, the citizens are increasingly demanding a focus on climate and the environment, and the politicians want to win voters. According to the latest national survey, water issues are the highest priority for citizens, but they're also interested in reducing climate impact. In terms of time, money and resources, we can't do everything at once, so the life cycle assessment helped us to focus our efforts in the right direction.

Is the life cycle perspective linked to any specific department, or does it permeate the entire organisation?

- In November 2014, the municipal council passed an environmental policy, and the proposal it was based on comes from the knowledge we gained through the life cycle assessments. One of our focus areas in it is 'consumption', which applies to everyone in the municipality. We also conducted environmental training for all municipal employees. The training is linked to our own environmental policy, our impact and what we must do to achieve our goals.

How has the life cycle perspective advanced environmental issues?

- Food, electricity, heating, transport and computers are

our top five list of priority areas. Food and computers were not a focus in the past, but the life cycle assessments pointed them out as important areas. And as regards food, the life cycle assessment is the reason that our 2015 budget was expanded to further develop the issue and to reduce the municipality's climate impact due to food consumption in the public sector. The reports also gave us a greater understanding and awareness of these issues, and an understanding that we do have an impact outside of our 'own horizon'.

What concrete changes have you made as a result of the life cycle perspective?

- We have a project in which teachers, school kitchens and pupils work together to enhance our understanding of the impact of food and food waste. We've created educational videos on food waste for school children. In addition, we're going to arrange a competition between schools on the theme of food waste and look at the possibility of financial incentives for schools to reduce their food waste.

Do you have an example of a life cycle based change that has led to reduced environmental impact?

- We have two examples that in many ways originated from the life cycle report, although not solely from it. As always, there are many factors that lead to new regulations. For example, the food issue has received extra budgeting based on the life cycle assessment. We've also looked into our computers, which the report told us had a significant impact. We have reduced the strain on our computers' capacity and thus enhanced their lifespan, and this has already been implemented in our schools.

"If we hadn't had a good understanding of the big picture, we would have focused on electricity, heating and some traffic emissions, but we might have missed the food aspect."

What do you see as the greatest incentives for enhancing your municipality's life cycle approach?

- It's our responsibility as a municipality. We are a part of the nation's environmental impact and that is one of the five focus areas of the municipality. We've developed the knowledge and now the politicians are asking for it. To work on this focus area, you need to be aware of your impact, and the life cycle perspective is the foundation. Half of our employees are teachers. If they in turn convey a sustainability mindset to their pupils, who perhaps go home and talk to their parents, there might be a strong ripple effect.

What tips do you have for others to get started on or further develop their work on life cycle perspective?

- One thing is to think outside the box, but above all, to carry out a life cycle assessment to learn where you really are impacting the environment so you're working with the right things. That prevents sub-optimal solutions and creates greater faith in your abilities. If we hadn't had a good understanding of the big picture, we would have focused on electricity and heating and some road traffic emissions, but we might have missed the food aspect.

There is a value in starting, even if you don't know yet whether it will be a long-term or short-term effort. And bring in external expertise if you don't have it among your staff. A life cycle assessment is a big undertaking, you have to understand the methods, set the right delimiters and so on. It would be exciting if a general database and model for municipalities were drawn up, since municipalities tend to be fairly similar.

Will you continue to apply the life cycle perspective?

- Yes, in concrete terms we will demand reporting of climate impact in connection with land sales just to create awareness. A primary objective of the environmental programme is to bring about an overall reduction of climate impact per resident, and this should be assessed every five years.

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[Municipality of Sollentuna's work on climate change](#)
[More examples of applied life cycle thinking](#)
[Swedish Life Cycle Center](#)

Life cycle approach at the planning stage

– Energy efficiency identified through life cycle assessment

This example is taken from Telia Company. Telia adopted a life cycle perspective to systematically investigate the options for energy savings, which included carrying out its own life cycle studies. These resulted in changes to working methods and in a change of focus, provided access to valuable data ahead of future investment projects and in particular saved a great deal of energy and money.

Telia has, among other things, established a completely new way of building, operating and using technology facilities and data centres which led to the development of their own cooling system, called the Telia Green Room Concept.

Telia Company provides the infrastructure for telephony and communications via the internet with a series of different technical solutions and systems. The company has operations in 15 countries, and the management in each country is responsible for operational activities there. The regions and group functions work closely with local management, providing advice and assistance on long-term sustainable operations. Telia Company is a listed company with 21,000 employees. Its headquarters are based in Stockholm.² Telia Company has identified energy, greenhouse gas emissions and electronic waste as its greatest challenges in the environmental field. But there is also the issue of how to get customers to use IT and telecommunications to reduce their own footprint. The agreed strategic objective is to 'minimise the negative and maximise the positive environmental impacts throughout the value chain'.³ In such a large organisation, which is also technology driven and constantly evolving, it can be difficult to gain an overview of the company's direct and indirect environmental impact.

Dag Lundén works as environmental manager in Technology in Sweden and has answered some questions about their experiences with the life cycle perspective.

How long have you been applying the life cycle perspective?

- Since 1997, when I and three other colleagues went on a ten-day course in life cycle assessment at Chalmers. We then carried out our first life cycle assessment on a videoconference system (CRT-screen based). CITEK (Chalmers Industrial Technology) carried out the study, but we were in the reference group and helped to collect the data. In the course of this we gained the theoretical training and tools to enable us to experiment a bit ourselves. This was actually when it really took off and it has been cruising along ever since.

What do you consider to be the biggest motivators for intensifying the life cycle approach in your organisation?

- Energy is the biggest motivator, it's extremely impor-

tant. But one thing that has surprised me is that the choice of materials when building for example a cooling system using aluminium or copper, also affects your overall footprint. What you choose and what you get your suppliers to choose and how it impacts the overall footprint. This then determines the way in which you recycle. Developing a means of setting the requirements for the choice of materials is an area I would like to investigate further.

The motivator for implementing energy-saving measures is strengthened as a result of the pure financial gains that can be associated with these. But implementing similar changes among end users is much more difficult, because the customer does not always prioritise the energy aspect, but may choose products more for their user interface or other features such as those available on a mobile phone. The customer often has a different set of requirements

“Short-term thinking muddles up the management signals sent out in the organisation.”

And what do you regard as the main obstacles?

- My personal view is that the Swedish Companies Act and in particular its link to requirements for short-term returns is the biggest obstacle. Short-term thinking as to what owners expect in the form of returns muddles up the management signals sent out in the organisation.

Do you think the life cycle perspective permeates the organisation? Is it easy to get proposals implemented?

- If we're talking about our own network and how you build and operate it, I would say that we usually push through energy-motivated investments, because we can show that they will result in cost savings. So it's quite well anchored on the network side. However, customers are more concerned about market issues and requirements. I would have liked to see a greater awareness of energy saving among our consumers. Business custo-

1. Telia, 2016: <http://www.teliacompany.com/en/about-the-company/our-operations/>

2. Telia 2016: <http://www.teliacompany.com/en/...company/telia-company-in-brief/telia-company-in-brief/>

3. Telia 2016: <http://www.teliacompany.com/en/sustainability/responsible-business/environmental-responsibility/>

mers set requirements, but residential customers often set none at all. At the same time, we are already setting tough requirements for our suppliers of the equipment installed in our customers' homes (such as routers) to offer energy-efficient alternatives. According to research we carried out ourselves, approximately 60% of the energy consumption comes from end users and 20% is from data centres, while 10% is from our own network.

What specific changes have you made as a result of applying a life cycle perspective?

- We know from previous life cycle studies that data centre cooling consumes a lot of energy. We have therefore focused on this area internally. We have set up a completely new way of building and cooling data centres, which is known as the Telia Green Room Concept. Cooling generation accounts for 30-70% of the energy consumed in a data centre.

Why is this an inspiring example?

- Partly because it was a good study but also because it took a proactive approach. The life cycle approach made us think proactively so that we included all steps in the chain. By taking overall responsibility for the design of the data hall, we could also enter into a dialogue with the different contractors involved in the project and in doing so ensure that the optimum solution was devised. This holistic approach was crucial to the success of the project.

“Life cycle assessments produce knowledge.”

Did you call upon in-house or external expertise?

- The expertise we have available 'in-house' enabled us to operate as a competent buyer. But the studies themselves were carried out with assistance from the academic by four master thesis students. One advantage of this approach is access to up-to-date tools and an up-to-date knowledge base.

Have there been any challenges with the work?

- We tried to make a comparison between this data centre and other similar external facilities, but couldn't obtain any information that we could use. This was despite having extended the project period considerably.

Which target group do you think could learn from the example?

- Anyone with cooling requirements can make use of our concept. But whatever you do, you need to take a proactive approach. Life cycle assessments produce knowledge. Sometimes it is not possible to make a complete assessment but you can obtain a great deal of

information by studying parts of a solution.

What results have been achieved in the organisation?

- We have succeeded in reducing our energy consumption significantly. Nowadays a data hall has an average PUE (power usage effectiveness) of 1.8 globally, but Telia's PUE is about 1.4. According to our own calculations the Green Room Concept can achieve a PUE factor of 1.06. The system is not only energy-efficient but is also capable of cooling extremely high output levels. The system is tested up to 55 kW per rack. The cooling capacity is also linear with the cooling production. By implementing experiences from the Green Room in Telia to other technology facilities and combining it with other measures, we calculate that we can achieve a 30% reduction in our energy consumption by 2017. And maybe as much as 50% by the 2020s.

How has the life cycle perspective advanced your environmental issues?

- We have gained the knowledge and information required to identify other possible areas to focus on. It determines the approach we take and what signals we send to the organisation. By finding the main energy consumers we have been able to focus our efforts on reducing consumption there, because life cycle assessment allowed us to find the phases in a process that we needed to take action on. We carried out a life cycle assessment to determine the Green Room's environmental performance and the results showed that it was probably the most efficient data centre cooling solution in the world. The studies carried out therefore provide a knowledge base showing what the environmental impact actually looks like and how it is distributed. This has affected the work we do internally, since we consider not only the initial cost when making a purchase but also look at the overall cost throughout its life cycle. This has long been part of the costing process when making investment decisions. Life cycle assessment is thus used to provide knowledge. The results were good and major energy savings could be made.

What tips would you give to others who want to launch or further develop their own efforts to apply a life cycle perspective?

- One piece of advice for anyone wanting to start carrying out life cycle studies or taking a life cycle approach is to first decide whether you want to acquire the knowledge in-house or to engage external experts. But even if you rely on your in-house life cycle expertise, you can also benefit by calling upon the expertise available in universities, for example. But you will not avoid the need for in-house expertise. You need to be a competent buyer.

Carry out industry-wide studies if you wish to make sure that you get the whole picture. Make use of somebody who knows how to do this. Don't try to reinvent the

wheel yourself. You need a certain body of knowledge in order to carry out a life cycle assessment correctly.

The biggest single motivator within an organisation is often money, and energy consumption costs money. The ability to make potential financial savings is a motivator for engaging in environmental work. Sometimes you can combine several different environmental measures into a package that you want to implement and by making financial savings at one end, finance the investments that you would not have made if you had put these forward one by one because the profitability was too poor. A holistic approach is preferable.

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[Telia's environmental work](#)
[More examples of applied life cycle thinking](#)
[Swedish Life Cycle Center](#)



Better results from applying a life cycle perspective

- Klimatkalkyl, a tool for calculating the climate impact and energy consumption of infrastructure

In 2014, domestic transport (all modes of transport) accounted for 33% of greenhouse gas emissions in Sweden. At a rough estimate the construction, operation and maintenance of the road infrastructure accounts for just over 10% of overall greenhouse gas emissions and just under 30% of the road transport energy consumption from a system perspective.¹

In this example, the Swedish Transport Administration explains how the life cycle perspective can assist in the decision-making process, since the tool it commissioned WSP to develop, Klimatkalkyl, provides a more complete report on climate impact. This is because Klimatkalkyl includes construction and its upstream emissions as well as future operation and maintenance.

1. Kunskapsunderlag och Klimatscenario för Energieffektivisering och Begränsad klimatpåverkan by the Swedish Transport Administration, publication 2014:137 (only in Swedish)

The Swedish Transport Administration is an agency responsible for the long-term planning of all modes of transport and for the construction, operation and maintenance of state roads and railways. In line with the national plan for the Swedish Transport System for 2014-2025,² any improvements to the transport system are to be tested on a step-by-step basis to make sure that resources are well managed and that the action taken will contribute to the sustainable development of society. Following on from this work a tool, Klimatkalkyl, has been developed that will have an impact on a significant element of the Swedish Transport Administration's activities from early planning and design work to the construction phase and maintenance.

To find out more about the Swedish Transport Administration's application of the life cycle perspective and Klimatkalkyl, we met Hanna Eklöf, investigator of climate and energy issues at the Swedish Transport Administration.

What does applying a life cycle perspective mean for you?

- Applying a life cycle perspective involves looking further ahead and not just thinking in the 'here and now'. You need to adopt a life cycle approach when working long-term on sustainability issues.

“You need to adopt a life cycle approach when working long-term on sustainability issues.”

How did you come to be involved with the life cycle perspective?

- The life cycle perspective often involves making both climate-based and financial savings. We want to find savings whether large or small, avoid sub-optimal outcomes and arrive at a more logical assessment. The government wants the Swedish Transport Administration

to account for emissions from construction and maintenance. In the past there was no model available that took a holistic approach to this, dealing with it from a life cycle perspective.

What are the advantages of applying a life cycle perspective?

- It provides a more complete and logical record of our impact from construction, operation and maintenance. The life cycle perspective often involves making both climate-based and financial savings, because it means thinking in the 'now' as well as backwards and forwards. As a result decisions made from a life cycle perspective are well-founded ones. We avoid unpleasant surprises in the form of climate impacts and management and maintenance costs. It helps us to find the most efficient measures.

What is Klimatkalkyl?

- Klimatkalkyl is a model which efficiently and consistently calculates the energy consumption and climate impact created by the transport infrastructure from a life cycle perspective. The tool is intended to reduce the overall climate impact and costs from a life cycle perspective by reducing the climate impact throughout the management stage. This is a tool that can help the decision-making process in relation to new constructions, and allow comparisons to be made between different locations, for example. However, the energy consumption and emissions of the actual traffic are not included. It has been decided in the Swedish Transport Administration that all investments exceeding SEK 50 million are to be calculated using Klimatkalkyl before a decision is made, but in the long term we may also apply it to smaller projects. Since Klimatkalkyl also includes future operation and maintenance costs, this will reduce the risk of a sub-optimal outcome at the construction stage. We can make smart decisions and optimise our climate change performance from a life cycle perspective by ensuring a more consistent assessment.

2. National Plan for the Swedish Transport System for 2014-2025 – Summary and references, Swedish Transport Administration, 2014 (in Swedish only)

How can Klimatkalkyl be used?

- The model can be used to carry out climate calculations on individual investment items and on parts of investment items. It can also be used as a tool for efficiently and systematically applying climate and energy efficiency improvements to infrastructure life cycle management. A limited version of the model is available on the Swedish Transport Administration's website so that other companies and authorities such as municipalities that own roads can also make use of the tool.

Why is this an inspiring example?

- Since all the Swedish Transport Administration's projects affect society as a whole, this tool has great potential to influence Sweden's emissions and energy consumption. The Swedish Transport Administration has the goal of making a 15% reduction in its climate impact from construction and maintenance by 2020 and 30% by 2025 (both compared with 2015).² The Klimatkalkyl model is extremely easy to use. We already have the input data we need, since it is based on the same data as the project costings. There are different levels to the model in which you can start by making rough estimates and then enter more specific data as the project develops."

"We can make smart decisions and optimise our climate change performance by applying a life cycle perspective."

How did you develop Klimatkalkyl?

- Klimatkalkyl was commissioned by the Swedish Transport Administration and developed by WSP. WSP collected the data and built the tool itself. They complied with the ISO standards for life cycle assessments.

Which parts of the life cycle have you worked on in Klimatkalkyl?

- We included everything from the extraction of raw materials to the use phase. Dismantling and waste management are not yet included, but their inclusion is planned for the future.

What benefit can the tool provide?

- The benefit of Klimatkalkyl is the data it provides to improve the decision-making process, since the infrastructure-related energy consumption and climate impact are included in this data. The tool also provides an option to identify and assess the effectiveness of energy and climate efficiency measures on infrastructure life cycle management. Klimatkalkyl provides a more complete statement, since the tool helps to provide a more comprehensive account of the energy consumption

and climate impact of the transport sector.

How has the life cycle perspective advanced environmental issues?

- In the long term we can see that applying a systematic and logical life cycle perspective will enable us to reduce the climate impact from our facilities. Since Klimatkalkyl also includes future operation and maintenance, this will reduce the risk of a sub-optimal outcome at the construction stage. We can make smart decisions and optimise our climate change performance by applying a life cycle perspective.

Who or what got the work started?

- Klimatkalkyl is a tool that has been long awaited, but the work began in the Swedish Transport Administration's environmental section as a result of a preliminary study. The environmental section, along with operation and maintenance, the investment operation, purchasing, environmental specialists and project managers have been involved in the work.

Have there been any challenges involved in developing Klimatkalkyl?

- We have had to adjust the terminology so that it corresponds to the terms that economists use. It has also been hard to interpret the results, such as the difference between different options.

What is your main obstacle to intensifying your life cycle approach?

- One obstacle is that we have different interfaces in the different tools that we use in our assessment of outcomes. An example of this is when we work on cost benefit analyses (CBA), which are not life cycle assessments. It can be difficult to compare the results and weigh them up to reach a conclusion. The fact that it is more complex than just dealing with the here and now is another obstacle. Different stakeholders are responsible for the costs at different stages of the life cycle. Those responsible for construction may optimise from the perspective of the building stage and not in terms of future maintenance and waste management.

What tips would you give to others who want to launch or further develop their own efforts to reduce the climate and/or environmental impact in their organisation?

- Think about where you can make the most impact. Is it through technology or through a change in behaviour? How can you work on these two aspects? The most important items are identified in the preliminary study, before building the model. Focus on making it simple and user friendly. Remember that Excel may be adequate for your purposes. It is important to create a simple tool that employees can make use of.

In addition to the example above on the use of Klimatkalkyl the Swedish Transport Administration also applies the life cycle perspective to the requirements set for dangerous substances in chemical products. Knowledge gained from life cycle assessments is used in decision-making data such as that used for an innovation procurement for wooden sleepers, evaluation of deer fences, use of nanomaterials and monitoring of the share of the transport infrastructure in relation to other sectors of society.

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[Swedish Transport Administration's climate work](#)
[Klimatkalkyl](#)
[More examples of applied life cycle thinking](#)
[Swedish Life Cycle Center](#)



Life cycle perspective in decision guidance documents

- Volvo Group's focus on improving energy efficiency in mobility

As a result of urbanisation there is an increasing demand for new transport solutions to reduce climate impact, since the transport emissions in large cities account for around 1.6 tonnes of CO₂ per inhabitant per year.¹ By applying a life cycle perspective Volvo found that the biggest environmental impact from transport came during the use phase in the form of fuel consumption. This was the basis for the development of electric vehicles in the Volvo Group.

Looking at products from a life cycle perspective has helped Volvo to implement changes in product development to reduce impacts specifically in the use phase. The first move towards electric vehicles is in urban traffic where the commercial and technical infrastructure is available.

1. WWF, Svenska kommuners koldioxidavtryck, 2010 http://www.wwf.se/source.php/1285817/Svenska%20kommuners%20koldioxidavtryck_FINAL_WWF-rapport_2010.pdf

Increasing urbanisation requires a more efficient and eco-friendly public transport system. Through life cycle assessments the Volvo Group has identified that electric power is most efficient by far from 'well to wheel', which was a key criterion for the choice of technology.

We met Lisbeth Dahllöf from the Volvo Group's life cycle team who explained more about this work:

- Our life cycle approach ensured that we focused on energy efficiency in the use phase early on. That led to the development of a hybrid vehicle that we could bring to the market with a fuel saving of up to 39%. A plug-in hybrid then followed, with an energy consumption that was up to 60% lower than a conventional powertrain. A fully electric bus with a fuel consumption up to 80% lower than that of a conventional powertrain comes out in 2017.

How does the Volvo Group apply the life cycle perspective?

- The life cycle perspective gives you a direction to work for so you know you're doing the right thing. We make sure to consider all the environmental aspects before making the decision to develop a product. Life cycle assessment is mainly used in product planning and product development.

"The life cycle perspective gives you a direction to work for..."

What do you consider to be the biggest motivators for intensifying the life cycle approach in your organisation?

- They are commercial in the first place, but society is also changing and we need to be well prepared and keep one step ahead. There's more and more talk about the increasing scarcity of resources and about the greenhouse

effect creating problems for society.

What is the key to success when applying a life cycle approach?

- Developing tools and training, using indexes and setting environmental targets. Targets are essential because they really make things happen.

What information did you obtain by applying the life cycle perspective?

- We've realised that scarce raw materials are crucial and that these materials should be recirculated in the technological loop. It's evident from life cycle assessments that energy efficiency is the most important area for heavy vehicles.

Do you have a concrete example of a change that has led to reduced environmental impact thanks to your life cycle perspective?

- Life cycle assessments have shown that electric power is superior to other powertrains if the electric power is produced efficiently and in an environmentally sustainable way.

How do you apply the life cycle perspective in this case?

- We have calculated the energy efficiency and carried out general life cycle assessments on batteries. We carry out a life cycle assessment if a technology is completely new, and when faced with a choice of technology. The assessment allows us to fine-tune the environmentally damaging aspect of the design. It is iterative work, with life cycle assessments continuing throughout the project to monitor and improve on the environmental performance. For example, in order to predict the environmental impact of electric buses, it's necessary to analyse different ways of generating electricity, depending on where in the world the bus will be used.

What tools and methods have you used in your focus on the life cycle perspective?

- We have applied Environmental Priority Strategies (EPS), characterisation methods in life cycle assessments, GaBi and DfX. We have developed a simplified life cycle assessment for product development ourselves in Excel. We publish life cycle assessment studies and have carried out an environmental impact assessment and FMEA (impact checklist) from cradle to grave.

We have also carried out a qualitative environmental assessment which takes legislation and Volvo's requirements into account. We have worked with Design for Recycling and are in the process of developing an eco design.

Did you call upon in-house or external expertise?

- Both. We have often called upon the expertise available from Swedish Life Cycle Center. We have collaborated with several players on the electric bus. We have carried out research projects on the environmental impact of batteries, financed by the government and the EU. The electric bus involves a collaboration between the Volvo Group, Chalmers, Göteborg Energi and the bus operator Keolis.

"It's a really good basis for making a decision, as it makes the environmental aspects more visible."

What is the reason for applying a life cycle perspective in this example?

- In this case, we wanted to learn about the environmental impact of electric power.

Why is this a good and inspiring example?

- It's a really good basis for making a decision, as it makes the environmental aspects more visible. You can obtain competitive advantages by choosing the right technology at the right time.

Which target group do you think could learn from the example?

- Anyone who is interested in life cycle assessments and wants a guide to environmental impact.

What results have been achieved?

- The greatest benefit is that electric buses consume up to 80% less energy. The electricity used produces almost no emissions of carbon dioxide into the atmosphere, and generates much lower noise levels and no exhaust emissions.

Electric buses meet the need for a quieter environment in cities, and can even be driven indoors. KPMG has analysed the costs and benefits to society from electric buses. Another benefit is that the bus is quiet inside, thus improving the drivers' working environment.

Another conclusion is that electric buses will be used for longer since there is no reason to switch to a better technology in the foreseeable future. It's important for the scarce materials in the battery to be recyclable.

What tips would you give to others who want to launch or further develop their own efforts to apply a life cycle perspective?

- Start by focusing on the areas which have a significant environmental impact and which you can do something about in the near future.

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This article is part of the project entitled: Good examples – Inspiration for energy efficiency through the entire value chain, which was carried out with funding from the Swedish Energy Agency. You can find out about additional examples of applied life cycle thinking, read more about the Volvo Group's work on climate change or learn more about the life cycle perspective via these links:

[Volvo Group's work on climate change](#)
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Comparative life cycle assessment

- Conventional powertrain and plug-in hybrid

Emissions from the automotive industry include both the manufacturing process and the emissions produced when the product is used. For the automotive industry, both the type of fuel and its production play a crucial role in its overall environmental impact. Thanks to its life cycle approach Volvo Cars Corporation can focus on the car's entire life cycle and not just take action on the environmental impact associated with emissions in the use phase.

In this example Volvo Cars Corporation demonstrates how to adopt a life cycle perspective to carry out comparative studies. By using a life cycle assessment Volvo Cars Corporation was able to compare a conventional powertrain with a plug-in hybrid, and also highlight major differences between the different power generation mixes.

Volvo Cars Corporation has supplied cars since 1927. The company's headquarter is based in Gothenburg, Sweden with production sites in China and Belgium as well as Sweden. 62.5% of its employees, 17,806 people, work in Sweden. Nowadays, its largest market is China, followed by Sweden and the USA.¹ Volvo Cars Corporation applies the life cycle perspective both in relation to emissions of exhaust gases and in terms of providing sustainable products through the use of sustainable materials and remanufacturing.²

Jessica Andreasson, Environmental Analyst at Volvo Cars Corporation explains in further detail:

- At Volvo we have a long tradition of focusing on environmental issues, both in our factories and in the product development process. Our CEO, Håkan Samuelsson, has ensured that the environment will be a core value permeating everything we do.

“The life cycle perspective has given us a tool to understand the phase in which our cars have the greatest environmental impact.”

What does applying a life cycle perspective mean for you?

- By applying a life cycle perspective, you can see the overall environmental impact of the product, from the raw materials used, through the use phase until the car is recycled. We are increasingly viewing the car's environmental impact from a holistic perspective.

Why has the life cycle perspective become important?

- New conditions and the electrification of cars have made us become more proactive in our life cycle approach. We are working towards a fleet of vehicles that is more and more electrified, which will lead to reduced exhaust emissions in the use phase. Other phases of the car's life cycle will thus increase in importance instead

and we will need to focus more on them. Another issue that has caused us to turn more to the life cycle perspective is the fact that more and more rare earth metals and other resource-critical materials are coming into cars via electronics and we need to keep an eye on this. By applying a life cycle perspective, we can give our customers on different markets information about the environmental impact associated with powertrains.

How has the life cycle perspective advanced environmental issues?

- The life cycle perspective has given us a tool to understand the phase in which our cars have the greatest environmental impact. We can also visualise this down to the component level. This has allowed us to work on the components that have the greatest environmental impact. We have also begun a research project with Swedish Life Cycle Center, IVL Swedish Environmental Research Institute, and RISE Research Institutes of Sweden to investigate further how we can apply the life cycle perspective in Volvo Cars Corporation.

What do you consider to be the biggest motivators for intensifying the life cycle approach in your organisation?

- At Volvo Cars Corporation we have previously worked on the environmental impact of our cars by introducing lightweight materials and different technical solutions for improving fuel economy. We have now reached a stage where we realise that we need to focus on the environmental impact of the entire car, especially since we are aiming to sell a million electrified cars by 2025.

Which parts of the company have been involved in the work?

- Those of us carrying out the life cycle assessments work in the Environmental Attribute and Material Management section and we disseminate this knowledge within R&D, where everyone needs to be aware of the environmental impact of a component or characteristic. There has been a particular focus on the area of R&D

1. Volvo Cars, 2016: <http://www.volvocars.com/int/about/our-company/our-company-at-a-glance>

2. Volvo Cars 2016: <http://www.volvocars.com/int/about/our-company/sustainability/the-impacts-of-our-products>

working on the type of powertrain that our cars should have in future. They are interested in ensuring that we move towards cars with a reduced overall environmental impact, not just when our customers are driving the cars. In the long term, we will also disseminate and use the life cycle results throughout the entire organisation.

Do you have an example of a change that has led to reduced environmental impact thanks to your life cycle perspective?

- In our latest life cycle assessment we looked at two new XC90s with different powertrains – a conventional one and a plug-in hybrid. We expect the car to have a service life of 250,000 km, in other words customers drive our cars for a total of 250,000 km in the use phase, and with two different electric markets for charging. In the first instance the car was charged with electricity from a Nordic power generation mix and the other was charged with a Chinese power generation mix.

What were the results of the life cycle assessment?

- In the results we looked at the climate impact of both the XC90 cars throughout their life cycles. We could also see that the significance of the different life cycle phases varied between the cars. We saw that the impact of the use phase decreases significantly in the case of the plug-in hybrid while the impact from the raw materials used and the production phase increases. The extent of the decrease in the use phase is greatest when the hybrid is charged using a Nordic power generation mix.

What did you find most surprising?

- The most interesting was that the hybrid has a 50% lower overall climate impact when the hybrid is charged with a Nordic power generation mix compared with an XC90 with a conventional powertrain. I must stress here that this is the case when the car is charged with a Nordic power generation mix. The assessment results obtained when the car is charged with a Chinese power generation mix, which is not as clean as our Nordic electricity and is based to some extent on the use of lignite to generate electricity, is different.

Why is this an inspiring example?

- We are an automotive manufacturer with a clear core value that the 'environment must permeate everything we do' and we are ensuring this through our new focus on the car's entire life cycle and by taking action on environmental impacts other than emissions in the use phase.

Have there been any challenges with the work?

- The greatest challenge now is to ensure that the environmental impact of our future cars is less than that of our current ones, and to ensure that the environmental impact of our cars overall is decreasing through all life

cycles. Another challenge is to remain focused on several impact aspects and not just carbon dioxide, which is the natural focus of the automotive industry.

What is your main obstacle to intensifying your life cycle approach?

- It's difficult to reach out with the results to the right part of the organisation, and to translate the life cycle results into technical targets that can be measured and monitored.

"Another challenge is to stay focused on several impact aspects and not just carbon dioxide, which is the natural focus of the automotive industry."

Will you continue to apply the life cycle perspective?

- We've got a clear plan on how to introduce the life cycle approach into the production process and other decision-making processes that we face, such as in our choice of materials and in particular resource-critical materials. Some of our next steps are to improve our tools and obtain more data on battery recycling. We are also seeking to understand the environmental impact associated with more and more electronics and thus the use of rare earth metals that we see increasing in our cars.

What tips would you give to others who want to launch or further develop their own efforts to reduce the climate and/or environmental impact in their organisation?

- First of all you need to find out internally what stage the company is at today and what environmental impacts it currently has, and then work step-by-step towards what you want to achieve. I also think it's important for the management to decide that this is important and for the life cycle approach to become part of the organisation as a whole.

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*Interview, text and layout: Rebecka Hallén Jorquera, Project Manager, Swedish Life Cycle Center
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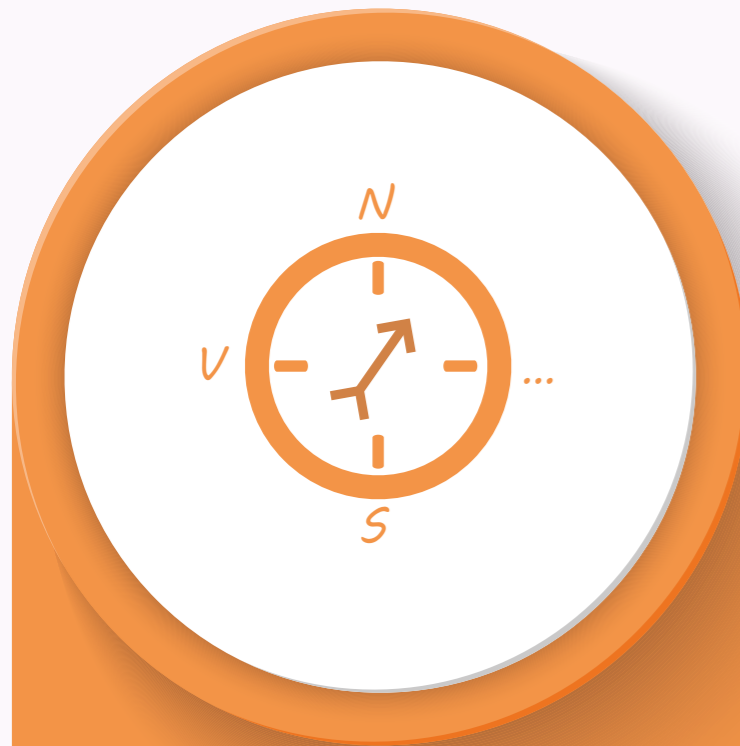
Checklist:

Getting started with life cycle perspective



Swedish Life Cycle Center

This checklist was developed within the project “Good examples – Inspiration to energy efficiency through the entire value chain”. The project was funded by the Swedish Energy Agency and coordinated by Swedish Life Cycle Center.



1. Map

Are you interested in adopting a life cycle perspective? Start with an assessment.

- ❑ Start on a small scale: Choose a product, a type of environmental impact or some other delimiter.
- ❑ Investigate the environmental problems others have identified as significant for this product group: What is under discussion in that industry and what do customers, environmental organisations, environmental labelling criteria say? What are the environmental criteria of the National Agency for Public Procurement, are there any scientific or other studies that we can learn from?
- ❑ Turn to examples of best practice for inspiration, for example Swedish Life Cycle Center’s project “Good examples – Inspiration to energy efficiency through the entire value chain”.
- ❑ Assess the product’s life cycle: What materials and components does it consist of and what’s their origin? How is the product used? What happens to it after the use phase?
- ❑ Get help: Does your organisation lack the necessary skills or time? Get help from a consultant, bring in a master’s thesis student or recruit someone who can work on this.
- ❑ Document: Save the data you collect – they may be useful.
- ❑ Draw conclusions: What conclusions can you draw from your results and what is prioritised? Avoid drawing to far-reaching conclusions – this is just an initial step!

Suggested methods: sustainability SWOT, simplified industry-specific tools, analysis of significant environmental aspects as per ISO 14001, simplified life cycle assessment (LCA) or footprinting study, i.e a hotspot analysis. Suggestions of consultants with life cycle expertise: IVL Swedish Environmental Research Institute, RISE Research Institutes of Sweden and Miljögraff.



2. Improve

Have you carried out an assessment and drawn conclusions about your product’s, service’s or organisation’s environmental impact from a life cycle perspective? Put them to use and make improvements!

- ❑ Identify who can make the improvement: Your own organisation, your suppliers, your customers (how the product is used) or some other stakeholder?
- ❑ Start from what aspects can be influenced and what does the most good, for example:
 - Improving your own production/processes: This can be linked to streamlining, which can lead to better technological and financial performance – motives that are not even related to the environment.
 - Product development: Depending on the most significant environmental aspect, you might change your choice of materials, reduce energy consumption in the use phase, or better prepare the product for re-use and recycling.
 - Make demands on your suppliers, and choose them based on their environmental performance: Is it possible to collaborate to systematically reduce the environmental impact?
 - Review your business models: Are there alternatives with a lower environmental impact?
- ❑ Spread knowledge internally: Which staff can benefit from the information generated and the improvements that have been made?
- ❑ Follow up on your results: Have the desired outcomes been achieved?

Suggested methods and tools for improvement: Eco-design, constant improvements under ISO 14001.



3. Intensify

Did your experiences with the life cycle perspective leave you wanting more? Then it’s time to intensify your efforts!

- ❑ Increase your scope or level of ambition: Analyse more products/types of environmental impact.
- ❑ Use more advanced tools: For example professional software for analysing energy and material flows and calculating their potential environmental impact.
- ❑ Add on the cost aspect: Calculate the life cycle cost or the product’s eco-efficiency.
- ❑ Learn more: Take a course, attend conferences or networks with other organisations that apply the life cycle perspective, such as Swedish Life Cycle Center.
- ❑ Get help: Does your organisation have the necessary skills? Get help from a consultant or master’s thesis student, or recruit a specialist in the field.

Suggested methods: Life cycle assessment/environmental footprint, eco-efficiency, life cycle costing/LCC.



4. Communicate

Do you have expertise in your product’s life cycle and environmental impact, and have you made improvements you want the world to know about? Then it’s time to communicate!

- ❑ First decide on your goal: What is relevant to communicate and to what target group – internal, suppliers, customers, end consumers or someone else?
- ❑ Decide on your communication format: Information on the website, an Environmental Product Declaration (EPD), a marketing campaign or an integrated part of the sales process.
- ❑ Follow laws and regulations: There is strict legislation about what you can say and how you can use environmental claims in your marketing to avoid misleading consumers. Read at the Swedish Consumer Agency, learn if there is a standard practice in the industry, and follow the standards of ISO 14020 series.

Examples of communication format: Environmental labelling, Environmental Product Declaration (EPD), environmental reporting, environmental statements in your brochures or on your website.