Sustainability Trends

And its Relevance to THULE

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02/06/2010

About this Thesis

This thesis has been written as a part of the degree project course in the Masters program "Sustainable Business Leadership" at the School of Economics and Management, Lund University.

The course was based on the methodology of action learning and self-managed learning. The students were all assigned to an in-company project, having a role as consultants. This project constituted the main part of the course. As a minor part the students were responsible for organizing several learning events addressing relevant issues related to the in-company projects. The students continuously documented their learning in learning journals and participated in tutorials on these journals.

The assessments of the students were done partly on the written thesis, partly on the consultancy process and report to the client company, partly on performance in learning events and partly on ability to document and discuss the students' individual learning and development.

Acknowledgements

I acknowledge the help and support of my classmates, especially my group in helping me do the necessary research and coming up with the data and analysis, as well as Professor Stein Kleppestø and Professor Christine Blomqvist in guiding and mentoring us. I thank Thule for the unique opportunity provided for our class, and especially Mr. Patrick Monahan, Vice President of Operations, Thule North America. I also appreciate and thank the respondents for our interviews, for giving us their time and input into this report.

Last but not the least; I thank my family and friends, especially my wife for encouraging me and supporting me to complete this thesis.

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Abstract

This document deals with the sustainability trends and the relevance of these trends to Thule AB.

The purpose of this report is to advise THULE AB about the trends in sustainable development practices. This document is part of our work thesis for master's degree in Sustainable Business Leadership Program, at Lund University, Sweden. The research was done with classmates Jorghe Cardozo, Bei Gao and Kaiji Sun, and sections of this thesis has a strong contribution of collective work in the group.

Sustainability is defined as meeting the needs of today without compromising the needs and wants of the future. Initiatives by the United Nations are highlighted in the report as well as the frameworks in place driving sustainability forward. The reasons for sustainability are summarised, and this report identifies sustainability to be an integral part of the business climate today. The report works to find sustainable trends that is relevant to Thule as well as of an economic benefit to them.

Sustainable trends identified from various publications were reinforced by interviews conducted with experts by the group. These trends include life cycle analysis, embedded water, ICT technologies, transportation systems and policies that will be governing sustainability in the coming years as well as sustainable use of resources and green materials. This report then makes an analysis of these trends, and find how the trends may be related to Thule as Thule starts their journey towards sustainability. Suggestions on what Thule can do with regards to different sustainability trends identified and discussed are given throughout the report as well.

1. Background and Introduction

1.1 What is Sustainability?

Sustainability is one of the keywords of a business today and is an issue that business leaders as well as employees are faced with every day. The success or failure of a company may depend on how sustainable the company is in the long run.

Environmental policies and acts were being introduced by the United States and other nations around 1950s and 1960s but it was in the 1970s that the United Nations started taking this issue, with the UN Conference on the Human Environment in 1972. This conference initiated a right of the human "to a healthy and productive environment" (Brundtland, 1987, p. 13).

The word 'sustainability' has been defined by various organisations and parties. The most well known definition for sustainable development is defined by the Brundtland Report as "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland, 1987, p. 54). Thus this report takes a 'needs' perspective in defining sustainability.

In the United States, a White House Council on Environmental Quality report in 1981 takes the natural resources perspective in defining sustainability, giving that "The key concept here is sustainable development. If economic development is to be successful over the long term, it must proceed in a way that protects the natural resource base of developing countries" (US EPA, 2010). Different variations of these two definitions exist, and the Bruntland Report definition is the most prevailing one.

These basic foundations of sustainability then lead to the Earth Summit in 1992, and the World Summit in 2002, and more recently the Copenhagen Summit in 2009. These international conferences have paved way to the international efforts for cooperating in global problems such as climate change and sea level rise (United Nations, 2002)

One of the main fallacies of sustainability is how little it is understood within the wider public – or perhaps how variedly it is understood. The economic and social resilience of mother earth will absorb shocks to the system (Giles, Simon, & Eric, 2007, p. 79), but the question is, how far does this resilience go? The triple bottom line stand of sustainability may be noble, but satisfying the whims of 3 separate groups of people at the same time would be a hard change. Obviously a lot of firms are trying very hard to jump on the 'sustainability bandwagon', but the firms need to get it right to be successful.

1.2 Reasons for Sustainability

Sustainability is at the pinnacle of business agendas at the moment. The reasons for firms to be more sustainable is numerous, and its impacts immense. These reasons can be financial, economic, doing right by the environment, or even enforced on it by governments or shareholders.

According to an MIT Sloan Management Review report, companies can incorporate sustainability measures to reduce cost to the organisation in the short term as well as in the

long term. The firm needs a strong analysis of its practices as well as its objectives, and re-align them with their sustainability efforts. Advantages of sustainability framework works well within the entire value chain of a business – from brand creation and market share to new market penetration and cost savings (Berns, et al., 2009).

"***Green can save you a lot of money – not two or three years from now, but now***", Catherine Roche, Managing Director, The Boston Consulting Group via (Berns, et al., 2009, p. 12)

"***We used to consider sustainability as a cost before, but not anymore. Now we know sustainability saves us a lot of money***" Goran Mathiasson, President of Operations, AlfaLaval AB.

Another important reason for sustainability is price shocks. With price volatility evident in energy and resources, as shown by the price of oil which hit over US$ 150 per barrel in mid 2008, and crashed to less than USD 40 per barrel by the end of 2008, companies more optimised towards sustainability will be less exposed to these price shocks (Crude Oil Price, 2009). Another important reason is the regulations. Governments are actively pursuing a sustainability angle, and companies actively exploring sustainability will be impacted less than others by future regulations. Also, first movers in sustainability projects will get an undoubted advantage over the competitors (Berns, et al., 2009). The same report also identifies that over 70% of companies report an improved image as a result of sustainability practices undertaken by them.

1.3 Aims and Purpose

The main aim of this study is to understand the general sustainability trends and find out its relevance to Thule. Thus, the main focus will be on sustainability in general and the prevailing trends. This report will also try to find what sustainability means to the world, countries, businesses and individuals. The current practices of companies towards sustainability will also be examined in this report, as well as government policy and regulations driving sustainability. We also look at new materials that might be coming up in the coming years that could benefit Thule as a manufacturing firm to be more sustainable.

The ultimate aim of this study is to prepare Thule for the future with sustainability as a core belief within the organization. The purpose of this study is to add to Thule's understanding of sustainability, what it is now, and the trends it may follow in the near future such that Thule can make better decisions with regards to 'sustainability' as defined in section 1.1 to be a triple bottom line view which tries to maximise the economic, environmental and social benefits. On the meeting with Thule AB staff on 25th March, 2010, I was lucky enough to talk to Patrick Monahan about the trends that would interest Thule. His answer is vivid in my mind – "***Give me the trends that would make us money***". In light of this, the report will also highlight certain trends that can be undertaken that could have a financial benefit for Thule in the short term as well as the long run. However, the recommendations are to be taken as an academic review and suggestions for Thule to explore further rather than a basis of a business plan for these suggestions.

2. Methodology

We started off by searching for documents online that can give us a reasonable insight to current trends in sustainability. Different publications by the United Nations and specially the Department of Economic and Social Affairs (DESA) publications were useful in identifying the general trends. Journals such as the MIT Sloan review, and various publications of consulting firms such as trendwatching.com as well as web articles formed a basis for us to read and assess the trends at the start of this project. In addition, we also support our research using the information collected by other project groups, like benchmarking and sustainability reports, to have a wider approach about how companies successfully accomplish sustainability practices.

We chose long interviews as part of our methodology to get deeper insights into a very new field of research that is being developed by the day. We felt that conducting questionnaires on such a new and uninformed topic might not yield the best results. We also decided to target individuals who are involved around the environmental and sustainability concepts from the academic world, as well as try to get interviews with managers of manufacturing or related firms on what their concepts of sustainability is as well as the current practices being done by their firms on sustainability. In this context, this research can be regarded as both quantitative and qualitative since it takes from the quantitative data analysis done by previous researchers and reflect on these researches through a qualitative analysis of interviews conducted with researchers in these fields. The qualitative analysis would give me a better understanding of the significance of these interviews from what is being said as it focuses more on words than numbers (Bryman & Bell, 2007).

Even though the interviews were being conducted on researchers primarily based at Lund University and conceding that there might be a bias towards Swedish cultures and norms, we tried to get our sample as varied as possible. We targeted researchers in different fields from economic history, environmental policy, and sustainability studies to material sciences and environmental sciences. It was also our aim to get the nationalities as varied as possible to reduce a 'Swedish bias'. Table below shows the interview respondents and a short description of their research areas, qualifications and experience.

Name	Background	Research Areas, Fields of work, Education and Experience
Barry Ness	American	Sustainability Science, Land use, Agricultural studies Ph.D. Sustainability Science, 2008 M.Sc. Environmental Studies, 2000 B.Sc. Economics, 1994 http://www.lucsus.lu.se/html/barry_ness.aspx
Torsten Krause	German	Climate change and conservation policies Current Ph.D. Student M.Sc. Environmental Studies & Sustainability, 2008 http://www.lucid.lu.se/html/torsten_krause.aspx
Christian Stenqvist	Swedish	Efficiency in industry Current Ph.D. Student M.Sc. Engineering, 2008 B.Sc. Environmental Studies, 2005

		http://miljo.lth.se/english/research/personal_homepages/christian_stenqvist/
Astrid Kander	Swedish	Inter-relations of Energy, Growth and the Enviromnent Ph.D. in Economic History, 2002 B.Sc. Economic History and Philosophy, 1993 B.Sc. Education, 1985 http://www.lu.se/o.o.i.s/9687
Carl Dalhammar	Swedish	Environmental Policy towards Sustainability Ph.D. in Environmental Law M.Sc. in Environmental management and policy http://www.iiiee.lu.se/C1256B88002A83F9/Web%5CAllPersons/C7E2758D62A12D96C1256BE4005168DE?OpenDocument
Guoqing Gao	Chinese	Materials – bearings Guest researcher at Industrial Production, Lund University http://www.iprod.lth.se/personal/
Srinivasan Iyengar	Indian	Materials Engineering Associate Professor at Lund LTH http://www.material.lth.se/staff/
Göran Mathiasson	Swedish	President of Operations, AlfaLaval AB B.Sc. Engineering Over 30 years experience at AlfaLaval, over 7 years as President of Operations http://www.alfalaval.com/about-us/investors/corporate-governance/group-management/pages/group-management.aspx

Table1: Interviewees and their publicly available qualifications

The interviewees were all qualified researchers in their fields, and the background has been varied as well as the education. They had a varied mix of higher education fields and certainly competent if not experts in their chosen fields. However, given that we wanted to do a face-to-face interview, a majority of the interviewees were educated in Lund University at some stage of their higher education. While we understand their opinions could have been influenced by the community and culture at Lund and its University, we believe that the researchers are qualified and experienced enough to give a balanced view on questions posed to them without significant bias.

All interviews conducted were semi-structured (Bryman & Bell, 2007); the reason being, we wanted to get as much insight as possible from these individuals on what their concepts of sustainability is and how sustainability is being shaped up by society. The scopes of the interviews were to get expert opinions on sustainability in general as well as ask the respondents some specific questions to get a view of the literature review done. Since this is the first time we have done long interviews, we did feel a bit intimidated by the interviewees, and the hesitancy did show in the interviews. In retrospect, it might have been better to have a more structured interview than we did. It certainly helps additionally in that we always got excellent suggestions to follow up on the research already done.

The scope of this study is to identify the general trends and specifically the trends that could have an economic impact for Thule as a manufacturing industry. I have identified potential cost saving trends in sustainability that can be beneficial to Thule if they have not been

already introduced, and even if they are, the suggestions could potentially open new avenues for Thule to explore as a manufacturing company. In addition to this I have identified trends that could be successful in the coming years in view of the current data available and in lieu of the expert opinions from interviews.

3. Current and Emerging Trends in Sustainability

All publications and interviews we conducted point towards the increased awareness and perceptions towards sustainability. This can be regarded as the most important trend. As such, more companies are reporting on sustainability as well as gearing their operations towards being more sustainable. From interviewing several researchers from different fields which we consider related, we derived the following perceptions discussed in this chapter concerning sustainable trends nowadays.

All respondents agree that sustainability is an important facet of life today, which cannot be ignored. The understanding of sustainability is varied, with some respondents focusing on environmental sustainability, but almost all respondents were aware of the triple bottom line of sustainability. Economic, social and environmental sustainability were discussed with all respondents.

One of the first questions arising from the interviews is a micro-discussion about consumption. The question of 'do we really need that?' comes up from time to time, for answers to personal mobility, materials, carbon emissions, active lifestyles, etc. The respondents agree on one thing, this question of sustainability is arising from the fact that human consumption has gone out of hand.

Of the trends analysed so far, resources use is high on the agenda. This would only increase in stature, given the analysis various organisations are doing into how globalisation has really changed the way we produce and consume. It is common knowledge that the European carbon emissions have come down over the last two decades, but some responds question the way they were reduced. Were the Europeans and OECD countries getting others to produce for them so that they could consume at ease? What sort of strains does this put on the resources for the producing countries? These questions are important for a manufacturing firm such as Thule to be aware of the life-cycle-analysis of their products.

Proper life cycle analysis is an important sustainability trend that is on the rise. With more and more firms publishing their sustainability reports, these reports will be coming under greater scrutiny and the chances for a company to be disgraced by reporting questionable figures will increase as well. However, some respondents did point out the practical difficulties of doing proper life cycle analysis (LCAs). First, how far behind do you go to the raw materials, and how far forward do you go towards a product's end of life? These 'technicalities' make it easy for firms to make false claims, and such claims could be included in their sustainability reports.

In addition, most of the respondents agree that embedded water is going to become a predominant issue with sustainability. Nowadays, companies are facing inefficient use of water in their processes, and are also leading to create additional operation costs. The common agreement that we got from the interviews is the imminent water scarcity that the world will have in the next decades. Therefore, companies that want to achieve sustainable behaviour must take into account water use efficiency.

The next question is how can an organization accomplish all of the changes necessary to become more sustainable? All of the respondents agree that successful sustainable changes such as water efficiency, energy efficiency, carbon footprint reduction and effective use of the land requires innovations in technology and information systems.

3.1 Policies dealing with Sustainability

One of the most significant trends in policies now is the amount of sustainability reporting being done by corporations. An increase in public demand for better reporting, corporate social responsibility (CSR) and environmental values meant that not only corporations, but also governments are coming up with initiatives in the form of legislations to make sure industry is answering to the public in a better way (DESA, 2006). Examples of CSR legislation include pension funds in UK having to take environmental, social and ethical factors before investing their money, and in Nigeria, oil companies are required to contribute 3% of revenues to the Niger Delta Development Commission (DESA, 2006).

International standards and best practices such as ISO 14001 and GRI reporting has been on the rise, with ISOP certifications less than 10000 in 1998 rising to over 80000 by 2004, as well as GRI reporting almost non-existent in 1998 increasing to over 2500 companies by 2004 (DESA, 2006). Companies such as ABB, H&M etc regularly publish sustainability reports. It is significant that more than 80% of largest European companies have started sustainability reporting (GRI or Global Compact) whereas less than 40% of the largest American companies did (DESA, 2006) showing a much higher awareness towards sustainability reporting in Europe. Another group of students are doing a more specific research for sustainability reporting and the scope of what I have done here is identifying the general trend that is an increase of sustainability reporting in the corporations.

From the discussion on policies below, it can be seen that policies affect the whole spectrum of sustainability measures that can be undertaken, and it would be interesting for Thule to analyse the legal and political environment to see how these measures can be utilised in a business sense. In a survey of over 2000 global companies, 20% responded that a lack of clear policy for the externalities as the most significant roadblock towards sustainability (Berns, et al., 2009).

Also of important note are techno-economic barriers which is barriers with technology and costs associated with acquiring such technology. Examples in a sustainability perspective are the high cost of new technologies that reduce pollution, the complexity of new technology, backward compatibility with existing systems and a general lack of information about new technologies (Carrillo-Hermosilla, del Rio González, & Könnöla, 2009). New policies are coming in to ease the burden somewhat, different schemes such as the carbon offset program of EU. However, a larger global effort is required as put forward by the former Secretary General of UN, Kofi Annan "***A global era requires global engagement***" (Annan, 1999), and even though the comment was made with reference to global peace, I think this is very appropriate for global sustainability as well. Perhaps the world will be seeing a more global effort for global policies after what is generally widely regarded as the fiasco of Copenhagen

2009 and signs are already appearing of it. There will be a World Congress on Sustainable Technologies in March 2011, whose website can be found at http://www.wcst.org/.

3.1.1 US EPA policies

Environmental policies in the United States come under US Environmental Protection Agency (EPA)'s jurisdiction. Its laws encompass the whole spectrum of environmental protection areas. The Clean Air Act outlines regulations for exhaust emissions from stationary and mobile polluting sources. The Clean Water Act regulates pollution entering the water sources within United States. Emergency Planning and Community-Right-To-Know Act is a law passed to combat and deal with emergencies such as community health and safety and environmental pollution due to chemical hazards. The Energy Policy Act encompasses the whole spectrum of energy from sources such as fossil fuels to renewable and nuclear, energy efficiency, tax incentives and more. (US EPA, 2010).

Analysing these acts in detail is beyond the scope of this thesis, and mentioning these policies outlines the need for Thule as a manufacturing company to be aware of the changes in the legal environment especially with a sustainability frame in mind. Failure to adhere may mean anything from fines to criminal prosecution for more serious crimes (US EPA, 2010), not to mention the adverse publicity such an event will surely follow.

Even though the agency started off as a prosecuting agency and watchdog, US EPA has now started a wide range of sustainability awareness campaigns. Educating the masses as well as aligning the agency activities to promote more research and development, improve ties with the wider economic community and create "market-based economic instruments" (US EPA, 2010) such as cap and trade systems. It is significant that even with the innovative policies that can and has been started by the US EPA, USA has a significantly lower tax on fossil fuels compared to EU and the fact that the energy efficiency of personal vehicles in USA dropped from 9 litres/100km in 1987 to 9.6 litres/100km can be attributed to a failure of making the necessary changes to policies and taxation to make it financially more attractive to be energy efficient (Banister, Pucher, & Lee-Gosselin, 2007). With the higher fossil fuel prices, this would have a tendency to improve obviously, but Americans are not willing to give up the car for an alternate form of transportation. "Until now, any sustainable transport policy, that would restrict driving or make it more expensive, has been a non-starter in the USA" (Banister, Pucher, & Lee-Gosselin, 2007, p. 24).

Although US EPA started out with air pollution, policies that deal with the urbanisation and its affect on ecosystems, life cycle analysis to review environmental impacts of products, technologies and policies over its entire life cycle, new technologies and materials as well as risk assessment are just a few areas that EPA does research to set their policies on protecting the environment (Office of Research and Development, US EPA, 2006).

3.1.2 EU policies

Policies in the EU had been getting stricter in recent times, primarily driven by a greater public acceptance and demand (Banister, Pucher, & Lee-Gosselin, 2007). Examples include a taxation policy for automobiles that reflect the amount of pollution created by it – or more correctly should be termed as how efficient the automobile is. These policies drive the energy efficiency in automobiles for new purchases, with automobiles classed into tax bands depending on their emissions per kilometre driven. Some countries such as England had gone a step further, taking the usage into account as well for example with the London congestion charge for driving through London at a certain time of the day (Banister, Pucher, & Lee-Gosselin, 2007). It would be interesting to know if adding additional accessories such as Thule roof boxes or bike carriages would have a significant effect on the emissions per km driven, and if so, what repercussions are brought about by policies in the future since I have not been able to find any policies that changes tax bands to such vehicle modifications.

In addition to automobile policies, EU also has a host of other policies that is pushing forward in reducing the emissions per household, such as mandatory double glazing in windows, thermal efficiency for buildings, communal heating etc. that is very visible here in Sweden. Such measures are being slowly adopted by other EU countries. The increasing tax on fuel levied in most EU countries made it more expensive to pollute or emit more CO_2, with a considerable increase in the taxes particularly during 1994 – 2003, but this move was suspended after pressure from various lobbies within a country. (Banister, Pucher, & Lee-Gosselin, 2007). But perhaps this would be the principle reason for EU cars to be much more fuel efficient compared to its American counterparts.

The respondents for us were all based in EU and they made some valuable insights into why regulations is important. Some see additional policies as a way of getting sustainable practices more acceptable as well as competitive. "***When it comes into pricing, that's regulation and it needs to be fixed through regulation. For example EU doesn't have a tax for kerosene and that's why it is cheaper to fly than taking the train***" (Thorsten Krause, 2010).

3.1.3 Carbon taxes and trading

Policies such as the Cap and Trade scheme is being touted as an innovative way to reduce carbon emissions and encourage innovation at the same time (The European Comission, 2010). Although I am not sold out on this idea, and I am sure I am not alone on this, this Cap and Trade scheme allows manufacturing industries to trade emissions permits that they do not use up (and which were mostly given free to them in the first place according to the European Commission) . The innovators gain by spending on innovations and modifications that allow them to reduce emissions and then selling off the unused permits to companies who need more. This is a dangerous precedent in my opinion, and there are signs already that this debate of carbon trading will heat up – and companies on the wrong side of this line could face a lot of troubles such as adverse publicity and a sudden and expensive investment to change their activities to be less polluting. In my opinion, carbon trading is just another

scheme to make a false sense of economic goods with an artificial or ever changing value, and 'sub-prime mortgage', 'oil price' and 'dot.com' comes to my mind. The lucky, the hardworking, and the devious may benefit from this financially but whether sustainable benefits can be achieved for the whole society from such a system is open to debate.

3.1.4 Fair Trade and Ethics

Fair trade has been a well covered topic in our masters programme. A lot of retailers are increasing the number of fair trade products as well as 'ekologisk' products. The debate is still raging on the benefits of fair-trade as well as the ethics of it. One such example is, if a shop has fair trade labelled coffee, does that mean the other coffee in that shop is 'unfair'? Doesnt this represent some sort of discrimination against the producers who does their trade fair, but does not have the necessary means for implementing the label? If so, can the fair-trade labelled coffee be considered some form of green-washing? The questions can go on and on, and I doubt if there can be a right or wrong answer to these. The relevance to Thule is lacking in this perspective since fair-trade at the moment is limited to textiles and coffee mostly, but eco-labelling is very active and it would be beneficial to Thule to explore the green credentials of its current manufacturing and resource sourcing to find out if they qualify for any well known eco-labels – especially in the luggage and packs department.

3.1.5 Why policies are important its linkages with other aspects of this report

Policies can be also regarded as the glue that holds sustainability together in my opinion. Without a check and balance system, any program or lifestyle would be left for the masses to derive the most benefit to them personally, as in human nature. Even though I have included policies as a separate part of sustainability, it is in essence the conjoined twin of every other aspect discussed in this report. For example, the US EPA has a specific program or policy called SmartWay which just deals with finding a cleaner and more fuel efficient means of transportation. This program brings together the policies and initiatives for a cleaner transport under one umbrella brand such that the awareness and recognisability would be increased for it (US EPA SmartWay, 2010).

3.2 Minimising Resources Used

The world population is on the rise. From a population of 2.5 billion in 1950, to 4.4 billion by 1980 and over 6 billion today, the United Nations estimate that the world population would balloon up to 8 billion by 2025 and over 9 billion by 2050. This places an incredible strain on the natural resources we have especially given the increasing standard of living and associated increase in the amount of consumption by the people (United Nations, 2002). Resources from food to energy and materials would have to be sufficient for a population almost double of what we have today, and the task ahead, according to the United Nations is not easy.

In addition to the increasing population, there has been a general trend of urbanisation as well. A century ago, only 5% of the world population was living in urban centres whereas now over 50% is living in cities. It has been projected that by 2050, 70% of the world population will be living in urban centres (Trendwatching.com, 2010). UN-HABITAT global report on human settlements highlight the different action plans initiated by the United Nations to combat the negative impacts of this rapid urbanisation trends such as crime, safety, health, environment and heritage amongst others (UN-HABITAT, 2009).

The resources are inexplicably interlinked, and potential conflicts of resources exists as well such as the conflict of getting greener energy via bio gas and the pressures of land use. This section will examine sustainability aspects of resources and to some extent the inter-linkages between them.

3.2.1 Energy & Efficiency

Meeting the energy needs of an ever growing society will prove challenging in the coming years. Energy consumption has been growing over the past few years, regardless of the type of energy or the region where it is consumed. (United Nations, 2002). That said, the global trends report of 2006 by the United Nations Department of Economic and Social Affairs (DESA) points out that "Energy consumption has generally grown more slowly than economic activity as energy efficiency has improved and economies have shifted to less energy-intensive industries and services" (DESA, 2006, p. 1). The same report points out that even through electricity use has risen over the past years, cleaner fuels as well as renewable energy sources and nuclear energy has kept the CO2 growth lower than growth in electricity. However, with natural gas having an energy density of 34 MJ/m^3 compared to its much higher density counterpart oil at 34 GJ/m^3, natural gas does not look like dethroning oil in the near future (Smil, 2009, p. 77).

From a manufacturing point of view, energy efficiency has been improving over the past two decades. The main reason for this is increasing energy prices, and although the rises in energy efficiency gains slowed down over the turn of this century, current prices for energy will undoubtedly kick-start another round of innovations (DESA, 2006). For example the amount of energy required to extract steel (in oil equivalent) has come down over the past 3 decades, particularly in China. (DESA, 2006). Multiple authors reflect the gaining efficiency in most manufacturing processes as a function of rising energy prices, but given the fluctuations of recent times with unprecedented highs and lows in 2008, I chose not to discuss these opinions in this thesis.

Renewable energy is a trend on the rise, with hydropower being the most significant source. However, hydropower can have a significant environment and social impacts on the region where it is produced, and is not forecasted to be on the rise. This difference is more than compensated by geothermal, modern biomass, wind and solar power installations. More efficient stoves to use the traditional biomass are having significant environmental and social benefits in rural communities. In addition to this, a significant amount of households have changed over to liquefied petroleum gas for their cooking needs, saving considerable time

and effort in getting wood for cooking. (UN DESA, 2002). On the bright side, the world receives an enormous amount of sun's energy (122 PW), which alone is more than enough to provide all energy needs of the globe (Smil, 2009, p. 83). If some way can be found to harness this energy economically, it would be a solution to earth's energy problems according to Smil (2009), but unless that happens, oil is here to stay. Smil (2009) also disregards large scale biomass as wishful thinking on their proponents' part.

Renewable energy projects are funded by the Global Environment Facility (GEF) projects towards reducing GHG emissions, but the most significant gains in reducing greenhouse gases were due to increased energy efficiency rather than increased renewable energy (DESA, 2006, p. 22). Along with GEF, Clean Development Mechanism (CDM) projects have been done been done principally to achieve Kyoto Protocol targets by the industrialised countries. (DESA, 2006, p. 22).

Another important trend is the uptake of small wind and solar installations by consumers. From remote summer houses to large supermarkets, these installations are providing clean energy as well as giving a backup power source and saving money on the electricity bill at the same time. Large buildings incorporating green initiatives into their design to make it more efficient, such as the 3 turbines between the Bahrain World Trade Centre towers (trendwatching.com, May, 2008). The same report also outlines personal wind and solar power has even transforming itself as a fashion accessory, with solar panelled handbags that enable charging mobile phones and music players, to devices that has solar panels on the back for self charging. This trend could be a relevant one for Thule with their Organization Solutions division, by incorporating 'green products' such as a solar charging mobile phone sleeve.

3.2.2 Water Use

Water use has been highlighted as an important trend that is on the rise, as well as a very significant resource that is under threat. Nearly half of the world population will experience water shortages by 2025 (United Nations, 2002). I was studying in Adelaide, South Australia in 2003-2005 and at that time South Australia was experiencing a severe drought, with state-wide bans such as bans on re-filling swimming pools, and this shows that even the developed world is experiencing serious shortages in water.

In addition to general water use, the concept of embedded water has been on the rise as well. NGOs such as water-wise has been increasing the awareness of embedded water in UK as well as globally. Embedded water concept revolves around the water that is associated with a product in a life cycle analysis. For example, to make a litre of beer, 75 litres of water is required (from resources to final packaged product), and proponents of the embedded water concept argues that importing a litre of beer is importing that 75 litres of water associated with it as well, and for a kilogram of coffee, over 20000 litres of water is used (Water-wise, 2007).

About 20% of freshwater use globally is used for industrial processes, hence the car you drive, the bed you sleep in, the computer I am writing this report with all has a certain amount of water associated with it. Water-wise also points out that different products would have different amounts of embedded water, and the same product produced in different areas would have different amounts of embedded water as well (Water-wise, 2007). Hence it is important for Thule to have a certain idea of how much water is used in its raw materials and its manufacturing processes.

3.2.3 Land Use

About 11% of the land surface is currently being used for agriculture. In some areas, a major proportion of the land available is already being used for crops, and expansion may not be possible, such as in South Asia (United Nations, 2002). The concept of growing the energy needs has been talked as a way to be more sustainable. It is well known that the sun's energy either is captured to a very small extent on earth, and getting a higher proportion of forestry programmes to be used as a sustainable bio-gas industry would see their chances of success diminishing as the pressures on available land increases.

The same United Nations report identifies that sustainable management of forests are growing due to various factors pushing for this such as regulations, social culture and consumer demand (United Nations, 2002). This is interesting since this points to efficient land use as a trend that is on the rise as well as linking land use to green and renewable materials such as wood.

Barry Ness, a researcher at Lund University and one of our respondents mentions this potential conflict between our need to survive and climate change. "***I see we have lots of pressures on land. And when you start looking at clearing land area that hasn't been used in the past for agriculture – intense agricultural production, you're releasing soil carbon, you're releasing different things out of the soil, all that carbon that has been sequestered there over the last thousands of years, hundreds of years, that gets released into the atmosphere, therefore it's exacerbating the climate change, not leading to any kind of improvement***." (Barry Ness, 2010)

I see Barry stressing on the pressures, and stressing that unmanaged or ad-hoc agriculture either for food production or bio-fuels production does not give a positive environmental impact. The question would then be, does it satisfy the triple bottom line of sustainability? Does the agriculture have economic benefits as well as social benefits? The food security and hunger alleviation would definitely be social, but how does that justify environmental degradation? In Barry's view all these questions are very difficult to find an answer, especially the right one.

3.3 Awareness

From a personal perspective, we have been growing up in a world with environmental disasters in everyday news and environmental forums a common occurrence locally and globally. In addition to the traditional news media, social networking websites such as facebook opens new avenues for the public to express on a mass scale, and corporations are making use of these 'tools' available to them to push their agendas with participation of the public. Some corporations are going a step further, by setting up their own websites, such as www.vtravelled.com by Virgin Airlines to enable like-minded travellers compile information about different destinations. It seems this trend of being aware and being part of the sustainability drive is very successful. "***People (in our company) are thrilled when they feel like they can be part of the solution***", Larry Page, Director of climate and energy strategy at Yahoo via MITSloan Management Review Special Report – The Business of Sustainability (2009).

Public awareness towards sustainability is growing as well according to trendwatching.com. Knowing and knowledge is a status symbol, and in a world with an increased tendency to over-consume, knowledge about the subject 'green' is an increasing trend and appropriately labelled as 'in the know' by them (trendwatching.com, May, 2010). This raise is also fuelled by a growing 'green' industry as well as more and more green consumers.

Different, yet simple things for the public to be aware of to save energy, time and resources are being made available by people 'in the know'. For example, in the Maldives, State Electric Company Limited (STELCO) where I was working from 1999 onwards, had an ongoing public awareness programme called 'switch off and save'. It might sound dumb for an energy company to have a public awareness programme to actually reduce the revenue of that company, but from STELCO studies, an increasing demand for electricity would have much higher capital and infrastructure costs for STELCO, an increasing amount of fossil fuels burned releasing CO2 and other pollutants, and ultimately affecting the social health of the community at large.

All respondents interviewed agree generally with the sustainability concepts and Brundtland definitions as well. However, all respondents say that the ultimate aim of the company is to make a profit, and the sustainability point of view is not detracting the company from it – some even suggested that if sustainability concepts were incorporated in their business activities, companies might even take it count in the balance sheet. "***The ultimate aim of a company is to make a profit, and the company has to sell a product to make a profit – which is not a bad thing. I'm not against capitalism. Selling the product is marketing, having a good product, different aspects coming into it***" and "***Now companies recognise the fact they should do their production in a certain way to minimise environmental impacts***" (Thorsten Kraus, 2010). Our interview with Goran Mathiasson of AlfaLaval yielded a similar perspective when he said that sustainability was considered a cost for the company earlier, whereas now sustainability measures are certainly beneficial for the company financially.

Another significant finding is that the for profit organisations showed a lower awareness level on impacts to sustainability than non-profit organisations (Berns, et al., 2009). Another way

of interpreting this result is they actually had a lower impact than non-profit organisations, but personally I see the policies being common to both as well as the environment, hence regarding it as a lower level of awareness. It could be beneficial for Thule to run awareness programmes aimed towards the staff to make sustainability as a concept more acceptable.

Public acceptability and the power of the public to help push on new legislations and actions on climate change has been a powerful facilitator in better sustainability practices worldwide. Banister, Pucher, & Lee-Gosselin, (2007) puts the wider public acceptability as the main reason for more pro-active environmental laws and policies in the EU compared to the United States. The report suggests that research in US does not suggest a public acceptance to change their behaviour in order to be more environmentally friendly, but generally in EU and other countries the trend has been overwhelmingly towards the environment.

3.3.1 Transport

Public transport systems play an important role in the society. However, transport systems contribute to urban pollution which will affect the social health of the community. In 2001, transport was contributing to around 30% of all energy use in North America and Europe. On top of that, transport accounts for over 70% of fossil fuels consumed. The only difference is fossil fuels costs in EU costs over double that of North America, and yet the transport system relies heavily on oil in both regions. (Banister, Pucher, & Lee-Gosselin, 2007). Transport sector had given an increase in greenhouse gas emissions between 1990 and 2003 in EU, USA and Japan, and this increase is much more when compared to the differences in industry (DESA, 2006). That said, transport systems has seen a considerable amount of innovations and policies especially with the EU countries ratifying Kyoto Protocol and having set targets to reduce their emissions by certain levels. A mix of policies, taxes, charges, and a general awareness amongst the consumers are making it possible for the governments to achieve their targets.

A significant trend in public transport systems worldwide has been transforming vehicles to cleaner fuels. Busses and taxis are increasingly using compressed natural gas (CNG) as well as petrol mixed with ethanol (E85) fuel, which not only makes the air cleaner, but reduces the dependence on fossil fuels. This coupled with better access to public transport is driving an upward trend for the stature and uptake of public transport (DESA, 2006). In addition to public transport, cities are embracing a cleaner personal mobility, with increased bike and pedestrian areas to promote use of bicycles and walking in the cities. When asked what the most energy efficient mode of transport would be, Christian Stenqvist, a researcher at Lund University and one of the respondents in our interviews, answered "***Bicycles obviously, I don't think any other mode can even come close***". This view is reinforced by Banister et. al. who cites the US Department of transportation increasing the federal funding available for walking and cycling infrastructure increasing from $6 million in 1992 to $422 million by 2003. The report also labels walking and cycling as the most sustainable methods of transportation (Banister, Pucher, & Lee-Gosselin, 2007).

Trendwatching.com puts Toyota Prius as the most iconic green product in transportation. With over a million cars sold worldwide, Toyota Prius is definitely successful with the buyers (News-team, 2008), and the sales does not seem to be slowing down at all. According to a survey, more than a third of the people who bought Toyota Prius got it to make a statement about themselves, which is more than the buyers who got it for the excellent fuel economy (trendwatching.com, May, 2008). The same report goes on to describe a number of hybrid and electric vehicles that may hit big in the coming months. One such example is the Tesla roadster which is an all-electric sports car that has amazed the most stubborn of petrol-heads such as Jeremy Clarkson of BBC Top Gear who exclaimed "***God Almighty! Wave goodbye to dialup, and say Hello to the world of broadband motoring. I cannot believe this. This car is biblically quick! This car is electric – literally!***" on test driving it on the show (Clarkson, May, & Hammond, 2008). As an avid fan of the show, if he can go on record praising an electric car, they are here to stay and will be a considerable part of the motoring future, hence Thule products will need to cater for electric cars, both super fast and mediocre.

Another important trend in the transport sector is green taxis. In cities and towns we see cars that have excellent fuel economy or running on biodiesel/E85 or both these characteristics together to be labelled 'green taxis' (trendwatching.com, May, 2008). These taxis are evident in Lund as well. Some cities such as Dublin have resorted to pedal power, with for-hire or free (advertisement financed) bicycle rickshaws called EcoCabs available in the city centre. Car hire programs and car sharing programs are very successful as well, such as ZipCar. These programs are being supported by communications technologies as a means of advertising, locating and accessing these cars (trendwatching.com, April, 2010). Given the rising popularity of these systems, Thule can find certain synergies that can be beneficial to the Thule brand in aligning itself as a sustainable company by partnering themselves with these brands – for example a Toyota Prius running on bio-gas being a 'green taxi' not only gives exposure to the green taxi brand but Toyota Prius as well.

Efforts of campaigners and environmentalists in highlighting fuel-efficiency of trucks and cars are one of the reasons for a major technological shift that has re-modelled the car industry. Over the last 3 decades or so, cars have become smaller, lighter, more energy efficient, hybrid, back to electric only, and even solar. From average 20 miles per gallon (mpg) about 40 years ago by the American standards, cars have improved slightly over the years. New American cars had 28 mpg in 1990 and there have been steady improvements over the years, but non-American cars have consistently outperformed the American cars in fuel efficiency (American Bureau of Transport Statistics BTS, 2009).

3.4 Technology Solutions and Innovations

3.4.1 Green Materials

Green materials are becoming more visible on the manufacturing side, and a lot of materials are re-branding themselves as green. One of the most visible is the ever-increasing visibility of bio-fuels and the associated bio-plastics. The green credentials of such systems are debated

amongst experts and a thorough analysis needed, but the US EPA had a long term goal of replacing 30% of fossil fuels with bio-alternatives, and at the same time admits that a large scale shift to bio-alternatives would need a huge commitment in space, infrastructure as well as finding an economical and efficient way to transport this fuel which would be less dense energy-wise compared to fossil fuels (Office of Research and Development, US EPA, 2006, p. 27).

3.4.2 Information Communications Technologies (ICT)

Low cost computers for developing world such as Intel Classmate and OLPC project

PC power management is a simple way to save a considerable amount of energy, as much as US$ 60 per PC per year, and as a trend, more and more corporations are adopting these systems. In a large corporation, energy savings from such a policy can be thousands of dollars or more (Klustner, 2008). As someone from an IT background, these are simple systems that can be deployed easily and without a significant capital expense, and at the same time its benefits would be instantaneous. From personal experience, replacing the old Cathode Ray Tube (CRT) monitors with newer LCDs saved a lot of energy and to top it off, most staff at STELCO reported that LCDs were easier on their eyes as well. However, my opinion is these programs need a significant staff participation and awareness to be really successful.

Transforming platforms to a more web-based platform has been a trend recently. Examples are web-based applications that remove a need for corporations to handle large computer server facilities with their associated maintenance, support and energy costs as well as the physical space requirements. An example is the Lund University moving their email and web pages as well as a lot of applications to SharePoint, as well as incorporating an increasing amount of Google online applications as part of the services available to students and staff. I have been lucky enough to be involved in such a migration back in STELCO Maldives, and in my experience, the amount of time and resources needed to give the same level of service to staff decreased by 50% or more, and at the same time most staff agreed that the quality of service available to them had increased due to the migration.

Trendwatching.com identifies what they call ‘now-ism’ as a growing trend. Now-ism is satisfying the whims of a consumer now, rather than the traditionally longer period it requires (trendwatching.com, October, 2009). Features such as online shopping, streaming music and video, e-books and e-book readers and other such innovations are becoming more popular. Trendwatching.com extends this ‘now-ism’ phenomenon to information gathering and publishing, such as the increasing popularity of blogs, twitter and social networks such as facebook, and the trend has only increased with advancing mobile communications (trendwatching.com, October, 2009). Instant buying finally tops up the wave of instant information. Examples include the rising trend of mobile banking, especially in the developing countries where infrastructure is not as well established as the OECD countries. Thule as a manufacturing company should be aware of how people are moving their purchasing, especially if Thule decides to sell direct to customers as well as through dealers.

Trendwatching.com also reports a growing trend of information sharing and leaving a permanent trail of oneself on the internet – either via social networking, personal websites, blogs, twitter accounts, Flikr, LinkedIn etc. The trend is being picked up by brands as well (trendwatching.com, June, 2009). A quick search on google.com for 'thule blog' shows that Thule has already jumped along on this track, as shown by the following:

- http://thuleroofboxes.com/ (a review of Thule cargo boxes)
- http://thuleroadtrip.blogspot.com/ (a blog about races with some Thule participation – last post 13/10/2008)
- http://bestbuythulerack.co.cc/ (an online shop with reviews and advice)

As well as the blogs, a further google.com search with 'twitter thule' yielded http://twitter.com/thule as the first result. An additional search on twitter website yields further results such as http://twitter.com/thulebrasil, http://twitter.com/ThuleAdventure, as well as http://twitter.com/thuleracks & http://twitter.com/Thule_Berlin. These twitter accounts had a grand total of less than 300 followers between them, which is not ideal but a start. There are brand twitter accounts with thousands of followers, and it is my opinion that Thule would benefit having a primary account that is very active. I have to mention the presence of a certain American air force base in Greenland called Thule Air Base yielded a substantial amount of results for both searches which takes the attention away from Thule products.

4. Current Sustainability Practices in companies

A more thorough examination of what other companies are doing specifically is being done by my group mates as part of their thesis, and I choose only a very short brief of sustainability practices here. This section is taken from the relevant section on consultancy report sent to Thule.

Generally companies are increasing the awareness of their staff, as well as incorporating sustainable practices into their everyday activities. For example HP has different tricks to save paper, from using recycled paper for packing to having printing options to reduce paper use. HP also has incorporated a lot of recycled plastics in their printers. IKEA has a top of the line logistics system that saves them time and money right from innovative packaging to streamlined delivery. Some companies were modifying their production facilities to make reduce energy in transit of semi-finished products as well as finished products. Coca-Cola has started a programme to reduce the emissions associated with its vending machines by replacing them with more efficient ones as well as replacing the refrigerants in them to a greener alternative (Ibrahim, Gao, Sun, & Cardozo, 2010).

5. Conclusions and Recommendations to THULE

The overall sustainability picture from this document is that sustainability is not one thing, but a mix of things that make the whole concept complete, from policies and innovations to regulations and awareness. In my opinion, this makes sustainability an ever present, but at the same time a vague concept, and always opens to debate. The aim for a company hoping to be sustainable is to identify these debatable things that they do, and make sure they have a solution to improve or change for the better. The following conclusions illustrate certain recommendations for Thule to follow up given the sustainable trends, and these recommendations are by no means an exhaustive list:

1. Green fuels are one way of being sustainable without compromising on the quality and efficiency of the operations. However, if Thule is going to invest or analyse green fuels such as bio-fuels, make a better life-cycle assessment of it. Thule would need to be aware of how the agriculture is being done for its green crops as well as its cultivation, how social standards were for the workers throughout the production and transportation process as well as the wider environmental implications of the green crop that is being used.

2. Bio-plastics could be a viable green alternative; again Thule would need to examine the life cycle analysis and the trade-offs with other alternatives.

3. Easy sustainability measures that would definitely save money starting now is possible, such as green alternatives for lighting as well as green IT systems. In-house IT policies would have to be made to reflect these green standards, and they should be enforced. If the staff does not enforce it themselves, it should be Thule who do it with automated systems.

4. New legislations may come up within the next few years in EU and North America that would have certain sustainability requirements associated with it. Thule as a manufacturing company needs to stay informed of these changes in legislations.

5. Car hire programs are a fair share of the market, and with a growing number of people choosing to use bicycles and hire cars when necessary, Thule may find it profitable to integrate renting their products in partnership with car rentals and car share firms.

Overall, some significant trends towards a more sustainable future were identified in this report. The overall trend is an amalgamation of trends, with a combined effort to reduce cost, green house gas emissions as well as save energy, and resources. A significant amount of trends concern policy changes or lifestyle changes to be more sustainable, and public awareness is pushing these trends further.

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7. Appendix A – Interview Transcriptions

A1 - Barry Ness

Barry Ness is a researcher and lecturer at Lund University Centre for Sustainability Studies (LUCSUS).

Team: First of all, what specific research areas are you in?

Barry: I'm in a number of different research areas; the over-all field is something called sustainability science. Specific research that I do right now for example I'm working on land acquisition processes, mainly in Africa, looking at large-scale land procurement, these large bio-energy or food production that's going on in places like Tanzania, Madagascar, Mozambique etc. I also have been recently working computer modelling of agricultural systems here in the region – namely sugar production systems from a life cycle perspective. So I am looking at multiple years, 2003 to 2015. I have been looking at the development of sustainability science, we've been working on a paper on that area and been doing some analysis of a forum website over the last 3-4 years, that paper is kind of on hold at the moment but we've been working with that.

Team: What do you feel about sustainability in general? That's the main question, what do you think of sustainability nowadays, and the future of sustainability?

Barry: This will obviously become a topic – area that will become more and more important as we start seeing more continued population growth, more and more of the negative effects not only from carbon releases but also bio-diversity laws, getting to what I have been doing with land use change issues and that kind of thing. So, this will only be something that becomes higher and higher on the radar screen I think – unfortunately.

Team: Personal mobility issues – do you see cars getting smaller and smaller and smaller as has been going on?

Barry: No, to a point – I mean, my personal experience is that, as long as gasoline remains at a level where it is now, sure that there would be efficiency via smaller vehicles, but that can only be to a certain level I think. My personal experience is that we bought a car that's too small for us now, so we're thinking about going back to something thats a little bit larger. The fuel efficiency isn't any better than a larger vehicle, especially when we do a lot of highway driving. So we have those kind of aspects happening in Sweden. I mean everybody would be downsizing where they wont have a giant Volvo that they had 10-15 years ago, but if you look at vehicle sizes in general there's got to be a size, an optimum size, for you to serve the purpose at hand.

Team: And if you have a rack over head or some sort of carriage – do you do any sort of adventure sports?

Barry: Yeah, skiing and that kind of stuff, mountain biking

Team: So you would be putting all your stuff up and...

Barry: Ski's go on the roof, but the funny thing was this car has the rack, we have one of those boxes and the box is kind of the same size as the car so it looks ridiculous.

Team: What's the brand of the box?

Barry: It's made by Thule – the Swedish (company)

Team: We have a project of Thule now – but we're not supposed to mention that but...

Barry: well, no, it's actually one of their brands – it's made by them but it isn't called that, I don't remember the brand name, we bought it last year. But it's funny on the car because it's so huge.

Team: Do you see adventure sports and these things getting more and more common, because people want to lead an active lifestyle? Or.....?

Barry: Yeah, but if you look at it from a Swedish context maybe no more than it has been in the past, but there might be different ways, for example if you're looking at mountain biking, skiing, this kind of thing that's going on that there might be different transport mechanisms to take yourself to the resort. So you need to potentially strengthen the infrastructure to get from Lund or Malmo, from southern Sweden to ski resorts. So actually 2 years ago we took the train up instead, packed our stuff in ski bags and jumped on the night train and went that route. And took a bus from the train station closest to the ski resort – it was a 2 hour drive then by bus and dropped off at the resort. So we had a really nice vacation without a car. Most recent one, we drove up to (ORE) with our car – the small car I was talking about, the car wasn't that practical in the snow – we used to have a Subaru AWD vehicle or something like that, something that was real – was designed for snow and winter use, and now we don't have that vehicle anymore, we have another small Subaru and it's front wheel drive and its front wheel drive and it's worthless in the snow. Next time I would probably choose taking the train again.

Team: So basically get the small one for day-to-day tasks, but when you're gonna go away, use public transportation.

Barry: That would be one way, or rent a car. My wife wanted to rent a car the last time too, something with a little bit more room. But the room is - I mean we didn't have a problem with enough space in the car because we were able to get so much in the box. So all the skis, the snowboards, boots, the poles, as well as a lot of the extra winter boots, the vests, the pants, that kind of stuff all went up on top.

Team: What do you think of sustainable materials? Do you see sustainable materials coming into a more prominent role?

Barry: Yes, but I see a potential conflict as well because my area of research focuses on you could say trade-offs with different production systems or just different systems in

general. So you could be developing more sustainable materials on something that's more bio-based, so you could have a bio-based plastic for example in your boxes. But then you need to look at the potential feedbacks in creating the bio-based products. In this case it might be involve land use that would create the plastic product, the base material for the product itself. Where does that come from? So we want to grow our ski racks, if that's what we're doing. If it can come from some kind of bio-based product or some kind of land based product. So then we need to say, 'Ok, how much can we produce here?' if all the plastic or all the materials we're getting comes from something that we grow or something that comes from some land area, do we have enough land area to support that? So then we see the instances of what's going on and we say – what should we do? Well, instead we should buy a plot of land in Africa for example because things are cheap there and we can get a long lease, then we can start growing our natural resources there or offset something that we grow or produce something in Sweden but then that means that we're having less food production or less natural resource production going on here, so then we need to go somewhere else to get all that stuff so we buy it from someone. We need to look at these different connections with the system that if we do something here, what does that mean? It means that we need to go somewhere else then to produce this kind of stuff. So you have these different connections specially with the land, but also with different production processes as well. So I see it as some kind of 'Yeah, but it's not a silver bullet', ofcourse we should try to do this but the question is, how does it actually work? How does it play out in actuality?

Team: What sort of trends do you see on the rise in.....(sustainability)?

Barry: I see we have lots of pressures on land. We see that happening now, lots of pressures on land. And then when you start looking at clearing land area that hasn't been used in the past used for agriculture – intense agriculture production, you're releasing soil carbon, you're releasing different things out of the soil, all that carbon that has been sequestered there over the last thousands of years, hundreds of years, that gets released into the atmosphere, therefore it's exacerbating the climate change, not leading to any kind of improvement.

Team: Do you think that the companies are aware about the issues?

Barry: Some of them. Most of them, you could say Swedish companies are particularly good. Some of them don't want to be aware of these kinds of things or just think that the market might solve this or whatever. A whole range or a whole continuum of companies that either bury their heads in the sand and say this isn't important to us all the way to 'yes! We understand the inter-linkages'.

Team: Do you think the companies are trying to develop sustainable energy developments? Would you say that they are doing related to supply chains? What are some of the things they are doing to improve sustainability in companies?

Barry: it's a whole range of things that have been happening. Those companies which are quite aware of their production chain and actually aware of where things come from, IKEA for example. We had a LUMES student here worked for IKEA and they go back where they can and take a look at the whole production chain, where's our stuff coming from? And then there are examples of companies that they might go back one step or 2 steps and say ok. These are some kinds of impacts, the sub-suppliers or different suppliers; do we know where they are getting their materials from? Do we know how this kind of stuff is produced, etc. More of these different sustainability indicators, are they actually aware of it? No! Not all of it. There've been lots of media reports lately about actually going back and actually examining where this stuff is coming from.

Team: Trying to do a full life cycle analysis as a growing trend but not really been embraced yet?

Barry: It isn't so much as in LCA, it's more of a life cycle sustainability assessment. Its not only life cycle assessment because lifecycle assessment only talks about environmental impacts, so looking at cradle-to-gate perspective, then you're saying OK! How far back to the cradle do we actually go? What social aspects? I mean sustainability doesn't only involve environmental impacts; it's got social impacts too. What are the conditions on the ground for these people that are producing the stuff. I think we had an example in Sweden recently with going back at gold, looking at gold production and what's going on with the social conditions in Africa that produces this kinds of things. Maybe find out there's a lot of 5 year old kids being sold off or being promised riches of working somewhere in a neighbouring country and basically being sold off to slave labour. These kinds of aspects is low (on the radar), which I think the whole movement has got quite good at 'ok! It's not only environmental impacts, it's also about people'.

Team: And commerce as well? I mean, you need to make money to...?

Barry: Yeah, but you don't necessarily have to. I guess you could say it's the paradigm that we're living in right now that there is this idea of a market. This kind of stuff is important but it's hard to say if it's needed or not. It's a whole other field of research.

Team: How do you think policies are affecting sustainability practices in a company, especially in the European Union and the United States?

Barry: It depends on what indicators you are talking about. My expertise is agricultural policy, and we all know about the common agricultural policy of the EU which you could say when it comes to development outside the EU is something that hinders some kind of sustainable development. I mean these policies have been changing over the last decade and now they have decided to make it more market oriented and that kind of thing but the debate between the WTO and free-er trade within the world trade organization versus you could say agricultural policies in both United States and European Union is quite different to what's actually happening. Protectionist policies

versus more free trade. So Things are changing slowly but probably not fast enough. If you are looking from a global perspective, things are definitely not changing fast enough.

Team: To become a developing country?

Barry: It's unfortunate but at the same time true, and its created, if you're looking at the perspective of the EU or the perspective of the United States, that its created a sense of you could say stability as well, that we have a stable production and consumption system here in Europe that's worked pretty well over the last 50 years or so. The cap was created by 1957 or 1958 and came into being in 1960, and deemed a success already by the 1970s. Now we started having other messy agreements that came in around the common agricultural policy that, more recently everything but an arms agreement, but maybe there should be some kind of trade between the global [south] and Europe. And we have an agreement on ACP countries, asian, carribean and pacific countries. We have those that kind of come in and make things very messy.

Team: Because quite a lot of nations in there?

Barry: Yeah, looking at the sugar sector, there's 22 countries involved in that. So once you start freeing, decreasing subsidies in Europe, what does it mean to these 22 countries which are producing sugar for the European market, their income goes way down. So we have a whole lot of Caribbean islands devastated because they can't sell sugar to Europe any longer. So it's a big complex, messy can of worms, you could say.

Team: What about carbon neutrality? What is you r stand on that?

Barry: Once again it's something that could be sought after but then first we need to step back and say, are a lot of these products that are trying to be carbon neutral or whatever, do we need the product in the first place? Do you need a ski box or a box for the roof of the car? Is it something we all strive after that we have or can we get by without it and jump on a train heading to the ski resort instead? Then I wouldn't need a ski box. So it's kind of built into a certain lifestyle and a certain type of wellbeing we're talking about, but is it wellbeing? That's just one way to look at it, i think taking a step back to this, again you need to be aware of the trade-offs, are we trying to create a carbon neutral production chain or whatever, that an art. You could say hidden aspects that you push somewhere else or you don't see or are not aware of.

Team: Do you see policies supporting this?

Barry: Generally, different policies and that kind of thing slowly starting to support this. looking at different types of CSR, and there's a whole range of them as a business. You have the inactive type of forces, they do the bare minimum, you could say incorporate these kind of things at-least in their brochures, that they contribute, that's their overall goal, whatever they are doing tangibly to actually create carbon neutral production chains and that kind of thing. And you have the active ones on the other

side who are actually trying to look into these processes and say how can we d this, bio based materials and this sort of thing

Team: Electronics, again it's a consumer thing and as a consumer would you say it's on the rise or exploding?

Barry: Just the amount of electronics that we're using is amazing. I mean personally I just bought a new computer this morning, I was in US in February and bought a new ac, I need a computer for the job , I need my travel computer, I have another computer now that I have just given back to the IT guy because they are a few year old.

Team: And would you be getting protective covering for every single one of them? Because you see people with sleeves, travel cases, or backpacks because the like having it on their back sometimes

Barry: I would tell you something I would do personally. I would get those for the things that are mobile

Team: And you see people going overboard, stuff like water proof casings for laptops

Barry: hmm, I wouldn't need it, I don't think. But it could be depending on your outings with environment quite often

Team: Another thing we wanted to hit on is embedded water use. Do you see it as a trend that's on the rise?

Barry: In-fact these other large systems that these things become more and more important as resources decrease. So we will see this is something that becomes avert, and maybe not so much in Sweden since its in abundance, but we see in other places this will become more of an issue. We see right now what's going on with the Nile, this will be happening more and more as we see the potential impacts of climate change. Areas becoming drier and whatever.

Team: So far we have identified 3 or 4 trends, carbon footprints the most obvious one, when they relate sustainability they say we have to correlate to use of cars and emissions and stuff like that, theres water footprint, use of land, do you have any other?

Barry: I don't know if this will sit with each other but you could do some kind of conceptualizations. I mean bio-diversity laws could be an impact of land use, it could be an impact of climate change, so all these things are connected, these systems or sub-systems, they all interconnect with each other. You can't change one without impacting the other. So are we talking about drivers or state conditions or are we talking about actual impacts.

Team: We're talking about the actions more. What sort of things are we doing about sustainability or what sort of trends?

Barry: So the responses? (yeah) so that comes back then to what can we do about it now? Where do you address the problem? you address climate change and that then has some kind of feed over effect to bio-diversity laws, could have a feed over effect to land use. So a lot of these come back to basic drivers of population, human population, there's just too many of us to start with. The second is consumption levels, we consume too much and its taking the resources. Its forcing us to change land use patterns, create production chains which use fossil fuels which emit carbon. Getting back to basic drivers, where does consumption come from? From our head, our needs to reproduce need to seek happiness. We need that car, that roof rack. It all comes back to how we're wired in our heads to seek happiness.

Team: Thats what we are trying to figure out as well.

Barry: Our needs to reproduce? Basic things, we want to reproduce and have offsprings and thats how we promote population. Because we have control over our environment, and we are doing a really good job of it and we're not dying in mass numbers like we used to, and we're living longer than we used to and having more kids. The question is, how do we reduce this population. When you think about it, this are big, challenging questions.

Barry: There are fundamental challenges that we face, and different in every country and region. Challenges such as HIV/AIDS, economic growth, urbanisation, how do you deal with the land use with the increased urbanisation? How do you deal with the policy challenges, all hard questions.

A2 - Torsten Krause

Torsten Krause is a researcher and a PhD student at Lund University doing research in climate change and conservation.

Team: What's your research area specifically?

Torsten: My specific research area is market based mechanisms for ecosystem conservation. How you can use economics and incentives or payments to protect ecosystems.

Team: What countries are you focussing on?

Torsten: South America. I am doing field work in Ecuador and I was there in January and February, and I plan to go back in November and December to do some more indepth research about a program where the government is handing out incentives (money) to private land owners to protect their forest.

Team: How long have you been interested in this specific zone?

Torsten: I did my masters in sustainability science in Lund, and this specific zone, after choosing the research topic last year.

Team: What do you feel about sustainability in general? For example some say global warming is a myth.

Torsten: Well, sustainability is much more than global warming. Global warming is just one aspect. I did my masters in sustainability science, and did my bachelors in business. From a business perspective, I think sustainability has been kidnapped many times as something you have to say and use in order to get new markets, keep customers or just be with the mainstream. If you look at it deeply, its very hard to achieve – if ever, sustainable development as a concept is criticized many times as it is rarely sustainable and can never be really sustainable. There is different dimensions of sustainability. When it comes to sustainability science, you try to look at a certain topic holistically, with open eyes, look at different drivers and outcomes of the problems, where they derive from and how to influence to minimise the negative outcomes.

Team: What about personal mobility? What sort of trends do you see in that?

Torsten: I personally like cars and driving cars, I don't have a car though, I have a bike. Sustainability scientics may be perceived as ecologists or green fanatics – which is not the case. You try to balance social, economic and environmental aspects of a certain research area. Cars are a good thing, but the way they are perceived in society and the way they are fuelled is not very environmentally friendly. What is the solution? It's not to scrap cars because its a very important mode of transport. Whats important is use it in a way it is less environmentally harmful and less harmful to society. Electric cars could be a solution, or use public transport unless necessary.

Team: How do you think companies are embracing sustainability? What actions are they undertaking in sustainability behaviour?

Torsten: The ultimate aim of a company is to make a profit, and the company has to sell a product to make a profit – which is not a bad thing. I'm not against capitalism. Selling the product is marketing, having a good product, different aspects coming into it. One of the things these days is to have a product is less environmentally harmful than it used to be or improve it all the time so that the impacts of the products are reduced. Ofcourse it would be stupid for companies to not sell this point, companies sell their products as more environmentally friendly, but they do use deceiving products when labelling 'sustainable' products – its not sustainable but just less harmful. Its still something thats consumed, maybe decreasing waste, whatever, but the government should regulate environmental standards, or inform consumers to make a choice. Even then, it is very hard for consumers to make an informed choice because often organic or fair-trade does not necessarily make it better. Now companies recognise the fact they should do their production in a certain way to minimise environmental impacts.

Team: We are doing the research for a team that does deal with adventure sports – skiing, rowing, mountain biking and that sort of thing. You have to travel to be active in these sports. What is your opinion on these?

Torsten: It depends on the sports. For example mountain biking and canoeing might not make a huge impact, but on the other hand, skiing would definitely have a significant effect on the environment, slopes would have to be prepared and things like that. Going to Austria is not the most environmentally friendly thing to do. But then again, look at the alternatives. What would people do if they don't go to ski. Would they go on a cruise? Go to a beach in Kenya? Go to Asia? A lot depends on the alternatives and choosing the least environmentally harmful choice.

Team: So calculating the lifecycle analysis for products, from manufacturing the devices right through to scrap, it really depends on how much you use it and where you use it as well, what would you say about life cycle analysis of adventure sports equipment.

Torsten: Sports, specially skiing is not something essential to your life, its not like clothes you wear to keep you warm. Its something you do when you value your personal leisure time when you have the money to do it. For example, if you go skiing, it might have acertain impact on the environment, but you experience the environment at the same time so you might value the environment around you more. If you go outside and do sports, you get a totally different connection to the wnvironment than you would get sitting at home on the couch, so in the long run those kind of people are susceptible to protests against environmental change. Its quite hard to make a statement here.

Team: What sort of sustainability trends do you see on the rise?

Torsten: I think concepts such as water footprint is important in getting people to realise the amount of water in things they consume everyday. They don't see the amount of water associated with a banana or a cup of coffee. CO2 is a very tricky thing, I think the whole concept of CO2 neutrality is totally flawed, there is no such thing as CO2 neutrality. If a company sells some products thats CO2 neutral thats a lie. You can compensate for co2 emissions by planting trees to reducing emissions somewhere else because you invest in a renewable energy project in a place where there won't be money otherwise. That's compensation, its never neutral. Its a step in the right direction, but not a solution. I don't think climate change would be a problem that's going to be ever solved. Looking at Copenhagen and recent trends, co2 emissions are increasing, so something is very wrong. I am not blaming any other countries for development, china and India has the right to develop as well, but the developed countries should help them to do it less harmfully.

Team: Your research area, is there anyone doing anything (about sustainability)?

Torsten: I think it shouldn't be either/or. It should be all together, carbon, water, resources used in the product. The first question going back, is what kind of product do you use? If you talk about a super fancy TV or computer or whatever it is, so many companies produce things that are not necessary, they produced because someone likes them so it comes down to the consumer. People has to realise that a certain lifestyle – mostly in the developed countries – and also increasingly in the developing countries, is not environmentally friendly and cannot be sustained. The way we consume is impacting

directly. Companies are just there to supply something people want, so we have to start with, what do people want? Companies will not spend on unnecessary things, which they know will not give them benefits in the long run. There has to be pressure from the governments, NGOs, consumers and others to demand improvements, to demand changes in production so companies will do it. Otherwise they won't spent the money, they cannot raise prices otherwise they lose competitiveness, they lose market share. It's not an easy question to answer very straight forward. I believe that companies do have the capacity to make changes quite fast.

Team: In other words the biggest threat or even the biggest trend is consumer awareness?

Torsten: Consumer awareness is one thing, even if consumers are aware, they won't necessarily spend more money on a better product because what matters most is the price. Some people will spent more for a better product, most people won't, especially in the developing countries as i understand. You want to pursue a certain lifestyle and have a certain amount of money to spend, why would you buy fair-trade coffee which is much more expensive than normal coffee – I know I won't buy that all the time. As i see it, there's a part for consumer awareness as well as government regulations for companies to reflect on what is required of a product, and maybe a certain kind of tax to equal out the prices between products that's environmentally friendly and products that aren't.

Team: Taking the policies part, what do you think about the EU and USA's policies about sustainability and what do you think they have to improve?

Torsten: I don't know what the EPA is doing, and I don't know what the EU is doing very much as well. What I know is that these government organisations are influenced by lobbyist groups a lot as well. They are powerful players, but they alone would not bring out the changes required in time – i mean we all saw what happened in Copenhagen. Politics is a very dirty field i think, and in many cases its not so much about the long term benefits but the short term benefits which are more costly for the environment usually. The regulations are good on paper, for example china has one of the best environmental regulations in the world but what's actually done maybe a different story.

Team: In developing countries, such as Ecuador since your research is there, what are the policies now being made?

Torsten: The same, Ecuador is one of the first countries to have given nature a right – nature has a right for being in a healthy state. They call it patsunamba, patsunamba is a concept in south America for mother earth. They have good regulations and the nature has a right in the constitution to be in a healthy state. Then you have the economic lobby, you have the economic situation and people who want to have an income. There is a bid clash between regulations and governmental policies and how they actually implement it, especially in countries like Ecuador where people do not have as much.

Team: So companies trying to be carbon neutrality would not be a solution.

Torsten: Not a solution, but a way forward since they are addressing the problem. You can see increasingly that companies are compensating their emissions or label the CO2 footprint. For example, timberland has a cO2 label in the shoes you buy. Carbon neutrality is one thing but looking at how it is being done is an important thing. For example in Brazil and Ecuador, they are planting eucalyptus trees for reforestation, which does not belong to South America and is an invasive species and they destroy a lot of biodiversity and ecosystems. So it depends on how it is being done. So i believe that companies need to be more careful of what they do because people are asking the right questions.

Team: So the awareness front comes here?

Torsten: The awareness front and that people are becoming more informed by NGOs and scientists. For example CDM projects – companies who use CDM projects to compensate for their emissions.

Team: As a consumer would you choose something more environmentally friendly such as public transportation over your own car?

Torsten: It always depends. If I go to the supermarket and buy a chocolate, and i have a choice between fair-trade organic chocolate and the brand I want to buy which is neither fair-trade nor organic, then for me personally depends on the day. I try to be conscious, think about whether pay double and buy fair trade or pay less and buy what I want. When I go to Germany sometimes i fly, because it is more convenient and cheaper and faster. Awareness is one thing, but in the end, there is always the price when choosing. So what has to be done is when it comes into pricing, thats regulation and it needs to be fixed through regulation. For example EU doesn't have a tax for kerosene and that's why it is cheaper to fly than taking the train.

A3 - Christian Stenqvist

Christian Stenqvist is a researcher and a PhD student at Lund University researching energy efficiency in relation to industry.

Team: What's your research area specifically?

Christian: My specific research area is Swedish energy intensive industry and the possibilities of that to energy and climate policies, so if they are threatened by energy prices that has gone up by EU ETS, carbon trading, pulp wood, cost increases, different ways they are threatened, and i am concentrating on energy efficiency.

Team: What do you see the trends in upcoming policies? Do you see the policies the policies getting harsher and more difficult to implement (in EU)?

Christian: EU is dictating a lot of rules for member states to adhere. Policy often comes from EU level down, that's a trend. It influences policy-making in that we have to always implement policies in the name of EU goals – like common market, and not to destroy competition and so on.

Team: Is EU more relaxed in the environmental policies compared to Sweden?

Christian: No, I don't think so. I think when it comes to energy efficiency, EU is important for Swedish policymaking and it pushes Sweden forward. Every member state would like to treat their industry well and generously and EU can make a difference in a way because they can say you are not allowed to treat your industries this good, you have to stick with the common agreement, so Sweden has to. The best example i studied is an energy efficiency program for big energy intensive industries, EU decided that Sweden should enforce a tax on electricity and this became a threat to the industry and they didn't want a tax. So they argued against it, and there was a paragraph on the eu directive saying if industries join a program for environmental protection or energy efficiency improvement, they can be exempt from tax, and Sweden directly responded to this and implemented this program. Now this companies, instead of paying tax takes part in the program, and from what I see, they are improving much more in this way than they would have with a tax in the way.

Team: So basically collaboration is better than enforcement?

Christian: I think so, yeas. Collaboration between EU, Sweden and industries is important.

Team: Do you see the manufacturing industries moving more towards energy efficiency or are they going for new green materials?

Christian: I think the companies are trying to improve what they already do. The other option would be more science or research focused and there are probably many research programs trying to improve processes from the beginning. Companies fund these research but in practice in their everyday operations they improve their efficiency.

Team: What would you say is driving this?

Christian: Probably cost cutting?

Team: What do you feel about sustainability – the term?

Christian: It is a good term, I like it. But it's used by different actors differently so it's hard to really understand. I accept when people say something is sustainable – I nod my head and I think I know what they mean. It's hard to define, i read the three dimensional definition and I think that the ecological part is the frame that sets the limit and then you have to improve social and economical aspects.

Team: Since you are dealing with efficiency, do you see cars getting smaller and more efficient?

Christian: Definitely, even in Sweden where cars have been big, it has decreased a lot over the last few years. And I think it's good that it wasn't so hard to improve mileage.

Team: Do you see that trend continuing for a long time?

Christian: I think in Sweden there is a good potential for decreasing size of cars. I am not a big car fan, I don't like cars and I don't own a car. I would rather live my life without a car. I understand that there are many people who need a car, 9 million people with over 4 million cars so need it. I am glad about a trend of decreasing fuel consumption, but I don't see a future of everyone on public transport.

Team: What about electric cars?

Christian: I don't really know if electric cars would, maybe if battery technologies develop. There are arguments against the electric cars that I don't really buy, for example they say you can't drive 100 or 1000 kilometres on 1 tank, and you have to recharge every – I don't know what. Who defines how the car should be used? I think it's the consumers who should decide, and before asking them I think it's wrong for the politicians and authorities to say that this won't be enough.

Team: What about carbon neutrality? Maldives wants to be carbon neutral by 2020, Copenhagen by 2025, do you think this would be something that catches on or do you think this would be possible? We did get a view that being carbon neutral is an impossible thing.

Christian: I think Malmo has a target to be carbon neutral by 2030, I think it's good. I know they have this target in energy and environmental strategy, but I don't think that people there really know what it is. For me they can say it, but I don't think it can be done in such a short time without buying CO2 credits or put money into CDM credits. However, you cannot use community tax for projects in other countries so there are obstacles. Carbon neutrality is an ambitious target and I think they have to be careful in defining and explaining what they mean. I think it's inspiring.

Team: Along with energy efficiency we see embedded water use. Do you see this concept cropping up?

Christian: In Sweden, there is a pretty low interest for water efficiency. Some people might want to be environmentally cautious because of what they learn in school, but I learned in university that water in this country is not an issue. Of course if water is heated, then its energy efficiency and that is important. When you buy a t-shirt, I hear that it takes 20000 litres of water to make a t-shirt, and I think this is important for the companies like H&M to be aware of these things.

Team: What about adventure sports such as skiing and mountain biking? It's healthy for you, but what about the environmental aspects?

Christian: I do skiing a bit, and I see ski resorts as a problem for environmental protection. On the other hand, tourism can cause an environmental awareness as well. The last time I was hiking, I took the train to a place, and then took a bus, then walked a long way and took the train back to Malmo. I tried wave surfing a bit and that had to be carried everywhere. When we went to Portugal, people were asking if we brought our dead grandma with us because the board container resembled a coffin a bit. I don't surf anymore because I do think it is stupid to carry around like that because it's not easy or convenient.

Team: What do you think is the most energy efficient mode of transport?

Christian: Bicycles obviously, I don't think any other mode can even come close. Other than that it would be a good public transport system.

A4 - Astrid Kander

Astrid Kander is a professor and researcher at Lund University.

Team: What do you feel about sustainability?

Astrid: Well politically I think it's a very powerful concept after the Brundtland Commission and it has been extremely successful about its diffusion, but it's still very vague concept. As a society we haven't be able to define properly sustainability, but I think I terms of certain areas, some researchers talks about the sustainable gap, that emanates from the predefines level of emissions, that environment can absorb with no critical consequences, and if the emissions are above this gap, you can evaluate if the gap is widening or closing. You need to have one criterion to evaluate sustainability. Sustainability in a way is a concept were you get together economic, social and environmental aspects, and the interesting thing is to see is there is a tradeoff between this three aspects, of there is a win-win situation.

Team: What sort of trend do you see in the sustainability field, because you have been studying the history of this term?

Astrid: One interesting thing is after this financials big crisis, what will come after that is a merger between development blocks of second industrial revolution which were built by electricity, and one with the internal combustion development, and it has started the microelectronics revolution, which can lead to create more environmental products, like for example, electronic cars that can be plugged during the night and that will be less wasteful, and creating consumer behaviour that not only act as producers, but also as part of the system.

Team: What about embedded water?

Astrid: It is also true in the energy and energy intensity area. The energy decrease by intensity in the developed world driven by us importing energy in commodities that we

get from emergent economies, so maybe it's not systemic change, maybe it's a divisional labor, globally.

Team: What do you think about policies that they are made nowadays?

Astrid: They are quite weak. Copenhagen was big disappointment for the energy sector, who was seeking for reduction policies. I think that has clearly shown that for example stock market shares of clean energy companies decrease after the COP failure. The whole thing has to do with some politicians that think that the transitions to renewal energies are going to be expensive.

Team: What about carbon neutrality, some companies are trying to achieve carbon neutrality from 10 to 15 years.

Astrid: I think it's a really good ambition. For some countries will be very difficult to achieve that, it requires a lot of high technology and energy efficiency improvements for example smart buildings that use solar panels and other kind of devices that provides alternatives sources of energy.

Team: What about sustainable materials? Do you see real sustainable materials?

Astrid: Good question. From my perspective material is never a problem, energy is the limiting problem. Material can be used and destroyed, but you can always put material again if you have enough energy. But I think the best way to have sustainable materials is to have an increase throughput in the economy of more bio-fuels, because it will represent a free source of energy, that doesn't have to create net greenhouse emissions to the atmosphere. We need to improve the photosynthesis speed. But it is also have to be taken into account the use of land area. This lead to create a social problem because some of the crops used to feed people can be used to do bio-fuels.

Team: As you said, this leads to a social issue, but there are also environmental consequences as well, for example deforestation

Astrid: Yeah, that happens a lot, even in Europe we had forest hundred years ago, the problem is not to cut the forest, and the problem is how to maintain a sustainable growth of deforestation. Now there is a trend of a sustainable way to cut the trees to preserve the eco-system.

Team: How about customer behaviour. Do you think there is a trend in car consumers towards the compact vehicles?

Astrid: Good question. I don't think we see it much yet, but over the last years there has been a drastic change about electric vehicles and hybrid cars and different types of transportation devices.

A5 - Carl Dalhammar

Carl Dakhammar is a professor and researcher at Lund University. His main research areas include: Environmental law, environmental government, consumption policies, industrial innovations

Team: What do you feel about sustainability?

Carl: Sustainability can mean everything. It involves economical, social and ecological development. It is a key issue for the future. Everything can be included.

Team: Do you feel governments are taking the right measures towards a better understanding of sustainability, taking into account your expertise in environmental regulation?

Carl: First of all, big challenges in sustainability nowadays are consumption and population growth. It is getting more and more difficult to solve problems with only given solutions and by technological innovations, because populations especially in poor countries and willingness to consume outgrows. The improvement that you make and it's very hard to couple resources from growth. How do we tackle these issues? How do we tackle growth? How do we solve those potential ecological problems whether is climate change or destruction eco systems, without having to resort totalitarian approaches like Chinese policies.

Team: What would you think it would be the most effective way to ….

Carl: Awareness is not the best way. Initiate effective policies and better economical instruments will bring technological innovations and will be directed with consumption.

Team: What are the trends in legal policies?

Carl: In Europe, the link between growth and development are not very clear. In developing world, economic growth equals economic development. Big race will be in carbon emissions and exports. There are different priorities in each country. In Europe is going to focus less on growth, Climate, Water issue is going to be much important come in a few years. Water technology is going to be a determinant factor.

Team: How do you think the use of embedded water a hit wonder in coming years?

Carl: Yes, it's going to be a huge issue, most towards Scarcity and providing solutions. Also, that you want to export to developing countries. What are the requirements to do that?

Team: What can you say about carbon neutrality? Do you see any country achieving carbon neutrality in the next 10-15 years?

Carl: Why not? You will probably see a country carbon neutral. It makes sense more towards carbon trading than developing environmental infrastructure. So definitely, it can be possible, but more as business rather than being 100% carbon neutral.

Team: In the same way, have you seen companies trying to be carbon neutral as well?

Carl: Yes. I saw couple of them. I think in all kind of sectors are seeking to become carbon neutral in any way. Actually, you can see a trend in this topic. Companies with a huge amount of emissions are seeking to achieve this subject.

Team: Personal mobility? What do you see about personal mobility?

Carl: Something has to happen. Governments gave up on economical incentives, now there are new regulations and policies in EU. There are new business model in electronic vehicles.

Team: What about cars, and active life style? Mountain biking?

Carl: I practice more traditional sports like tennis. But if you have three kids, you need a car. It's hard to imagine society without cars.

Team: Do you think there are good examples of countries with good regulations and policies about sustainability practices?

Carl: Well, yes, depends on what you mean. The Koreans have an interesting stuff in their regulation. It also depends in the way that you look at it. For instance, China is also making interesting stuff. In a different level, UK and France are doing interesting stuff as well. France is more related to GDP, not so much related to growth. UK has an approach more towards individual carbon codes.

Team: Basically, are you trying the whole population become aware about sustainability practices?

Carl: Yes. In the terms of individual carbon codus .If you have the carbon codus for food and for healthy food. Some countries are more mature mental think about how do you link quality of life towards sustainability. The traditional model about sustainable growth is definitely going to change. There are already some cities in Europe that said no to growth in the next 15 years. UK is a perfect example, they are terrible in the environmental dimension, but instead are thinking more towards lifestyle

Team: Who do you think different actors react in front of those kinds of regulations?

Carl: Sweden is quite disoriented society. Sweden is moved to more liberal solutions. More market solution, more growth agenda again. Swedish companies are more green, in here there are not so many industry resistance like in the US or UK. In general, we have a positive attitude towards eco friendly products.

Team: So far, you talked about EU regulation, and how different countries in Europe are approach environmental laws. What do you think about US? Do you think EPA is making the proper decisions?

Carl: No they aren't. US are in big mess now, because they cannot do so much big problems in senate. They can lose market share if they don't keep going. US still have a privilege position in technological innovation. You can see a lot of US technological companies with the major number of clients outside America. They have a lot of issues to take care of like health care, taxes, immigrations.

Team: What about sustainable material. Are they really sustainable?

Carl: I don't know. It has been a life-cycle analysis problem in the past. If you buy milk, it is paper better than plastic. Or aluminium is better depending on the quantity of material can be recyclable. Depends, they promise this future fantastic materials, involves some kind of risk but so far it has not been that successful. What you see in Bio-fuels is a lot of things that are supposed to be better, are not. If u change corn for ethanol, it can be devastating. In general, in the past it can be seen that bio-fuels are perfect example of a solution sold to the world and you get new problems with the solutions, like forest harvesting.

Team: About your personal electronics. Do you see with a lot of electronic devices

Carl: I stick with one only. Low as I can. But in general the trend is to increase

Team: Can we talk a little bit more about environmental politics. Why it work better in Sweden than in other places in the world?

Carl: First of all, I think in Sweden we are doing ok, but we are not the best. Like some other EU countries like Denmark or Netherlands, but we are doing ok because there's a consensus in society and special agreement with employers, industry, big labour associations, and also Swedish industries understood how to make money by acting green, so they are not as hostile as they can be. In a way, we are losing this quality to some extent, in the recent years. There's a big acceptance between consumers and producers. Denmark Netherlands and Sweden are leaders because they have a strong stable government system, certain degree of awareness between consumers, high education of the population, a lot of people expert in different field and strong conscious about the environment

Team: Can you identify trends that are coming in the future about environmental policies?

Carl: It's going to be interesting with growth and equalities in general. Water is going to become a big issue, because every economic boom involves resource scarcity.

A6 - Srinivasan Iyengar

Srinivasan Iyengar is a professor in Materials Engineering

Team: How do you define environmental friendly material?

Srinivasan: We have to think about eco-friendly material in a macroscopic perspective. The whole life circle of production should be counted. Resources of the material, energy and land use in producing process, transportation, waste treatment as well as reuse and recycling. Step back, to get a whole view of the life circle. Taking producing aluminium for example, producing aluminium from raw aluminium costs 35 times more energy than producing it from recycled materials.

Team: Is bio-base material a good replacement of the raw materials we are using today?

Srinivasan: Yes, it is more than eco-friendly. By using bio-base material such as plant oil instead of fossil oil, it is greatly improved the situation that we drill a hole for fossil oil to produce plastics, exhausting non-renewable resources. It is renewable and also possible to use the plants as fertilizer or stock for biogas. But the important thing is to retain balance. For example, Sweden is famous for paper production. They have rational land use system. When certain areas of forest are used, there are always more trees being seeded somewhere else to keep balance.

A7 - Guoqing Gao

Guoqing Gao is a guest researcher working at Production & Material Engineering department of Lund University.

Team: What's your research area?

Guoqing: I work for a company specialized in cutting machine, and my research area is particularly bearing and material.

Team: What do you think about green material regarding to sustainability?

Guoqing: For machinery, we are trying to use material has less negative environmental impact, but most commonly used material is steel. It is hard to say, how to use advanced technology to make the least waste is very important. To make the least waste in complicated process is more important in production, as well as decrease noisy and other pollution.

Team: What is obstacle for industry to use green material? How are they becoming more involved in environmental issues?

Guoqing: Companies pay more attention to customer demands, quality control rather than raw material. As companies, maybe first they will consider cost. They are responsible for their employees, and response to related policies is obligation, too. But still, the responsibility is always been considered first.

Team: What about personal mobility?

Guoqing: It is a dilemma in China. On one hand, government encourages the development of automobile industry, on the other hand, control the use of private cars with environmental concern. It's controversy.