

CAMPUS GREENING AT CHALMERS UNIVERSITY OF TECHNOLOGY

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1. Introduction

Chalmers University of Technology is situated in Gothenburg on the Swedish west coast. Research and teaching, conducted on a broad front within technology, the natural sciences and architecture, are carried out by Chalmers 17 departments. Chalmers has two campuses, Johanneberg and Lindholmen, both located in central Gothenburg.

For several years, Chalmers has conducted an internal environmental campaign with the goal to reduce the environmental stress caused by the daily work done at Chalmers. As a driving force in this work, annual environmental goals are established. These goals include aspects such as the handling of chemicals, sorting of waste or reduction of environmentally demanding purchases. Successful internal environmental work validates the credibility of our vision, “Chalmers for a sustainable future”. Our vision highlights the direction of our research and education efforts. The obligation to acquire at least 7.5 credits in environmental science and sustainable development courses is an example of this¹. Students also have the opportunity to obtain primary competence in environmental science as a part of all programmes of study, which is an exceptional feature of study at Chalmers.

As a direct consequence of our vision, Chalmers’ President, Karin Markides, recently launched a new approach, the Chalmers Initiative. This is a strategy for how the university will meet the challenges and opportunities of the future. The Chalmers Initiative shall stimulate cross-disciplinary interaction and cooperation, as well as promote continuous strategic processes to encourage development over time. The Initiative emphasizes the variety of perspectives of Chalmers: industry and communication, material and bioscience, and systems and environment. Our former president, Jan-Eric Sundgren, has previously formed Chalmers Environmental Initiative, CEI, a research programme concentrating on environmental systems analysis. It is centred on seven professors and their

research groups, representing seven approaches to systems analysis. A major goal of the CEI project is to stimulate cross-disciplinary interaction and cooperation between research groups and departments.

The Alliance for Global Sustainability, AGS, is another example of Chalmers' work for sustainability. This is an international partnership of four of the world's leading universities in science and technology: the Swiss Federal Institute of Technology, the Massachusetts Institute of Technology, the University of Tokyo and Chalmers University of Technology. The AGS was founded in 1997 and today it brings together hundreds of university scientists, engineers, and social scientists at the intersection of environmental, economic, and social goals.

A unique asset in Gothenburg is the Centre for Environment and Sustainability, GMV, which is a network organisation at Chalmers University of Technology and the University of Gothenburg. The GMV not only creates and encourages research projects and multidisciplinary initiatives, but also promotes research and education for sustainable development. More than 400 scientists are involved in the GMV's research network.

The Education for Sustainable Development at Chalmers, ESD, is a project within the GMV. The ESD project should establish, in a three-year period, from July 2006 to June 2009, an organisation to improve the environmental and sustainability learning at Chalmers. A professorship established at Chalmers in education for sustainable development, as appointed by UNESCO, is the initiation of the project. More information about the ESD project is available on the web page: www.chalmers.se/gmv/EN/projects/esd_chalmers

To build this new organisation, nine "action lines" were identified to stimulate and facilitate studies in environmental and sustainable development. One of these action lines is to support the improvement of our campuses, reflecting Chalmers initiative for sustainability. To succeed with campus greening, cooperation with two real estate companies is necessary. Buildings and surroundings at Chalmers are owned and administrated by both two real estate companies, Akademiska Hus Väst AB and Chalmersfastigheter AB, each owning about half of the buildings. The former company is part of a national corporate group, which owns university buildings all over Sweden, while the latter is a subsidiary of Chalmers University of Technology. Cooperation between Chalmers and the real estate companies has been going on for several years, resulting in some of the projects discussed below. Recently, this joint effort was intensified; consequently, through the ESD project, Chalmers collaborated with the real estate companies in a project for visualization of campus greening, which is described and discussed in this paper.

The objective of this visualization project is that visitors, students and personnel shall understand that Chalmers is at the front line in environmentally adaptable technology research. This should be easy to see and experience, when entering our campuses, in the form of illustrative examples of environmentally adaptable technology, such as solar cells, or landscaping of stimulating surroundings. Campus greening is also an excellent opportunity to show that Chalmers really practices what it preaches according to the vision.

2. Aim of the study

The aim of the study is to devise and put into action a method to visualize the initiative of sustainable development at Chalmers through campus design. Results, problems and conclusions are discussed. This article also reports on some sustainable development projects already carried out on campus, but which were not a part of the visualization project.

3. Methodology

In the autumn of 2007, the visualization project was carried out. The methodology used was relatively simple and straightforward. First, several ideas for visualization of sustainable development on campus were identified. Second, the ideas were discussed and investigated, which resulted in plans of action including time, costs and people in charge of each idea. Finally, the ideas were to be concretized following a chosen time table.

The ideas arose from discussions between people active at Chalmers, including an appointed reference group. Inspiration was also found in articles on similar projects at other universities. A Ph. D. student in environmental sciences, in close cooperation with the environmental coordinator at Chalmers, acted as the project coordinator. The reference group met three times during the term of the project to discuss and select the most attractive ideas to be investigated further, based on information provided by the project coordinator. The reference group included representatives of teachers, researchers and the students at Chalmers. The real estate companies were also represented, as well as some other organisations, such as GMV mentioned above.

4. Results and discussion

The results and discussion are divided in two parts: first the plan of action for visualization of sustainable development is discussed and, second, examples of environmental measures already realized on campus are described.

Visualization of sustainable development on campus

Visualization of sustainable development on campus is a challenging project, in which both major and minor ideas are discussed and planned. With help from the reference group, the project coordinator and the environmental coordinator discussed and sorted all of the ideas according to importance and feasibility. At the end, a plan of action was offered to the actors involved. The plan of action included a selection of the most urgent ideas to be put in practice; the ideas had been grouped, to enable taking advantage of synergy effects. A short version of the plan of action with examples from each group is discussed below. The overall plan of action is given in the Appendix.

Increased cooperation between actors on campus with emphasis on campus development

The aims of one group of ideas are how to increase the number of university courses with an element of environmental science, sustainable development, or both in them and how to use the campus in teaching. Using the campus as a central element in courses means that students can work with actual tasks and both the real estate companies and Chalmers can enjoy advantages of the student work. A group including representatives of teachers, researchers, the Student Union and the real estate companies has been formed to discuss needs and expectations of all parties and the best ways to increase cooperation in using the campus in teaching situations.

A course in design and product development, held at Chalmers in spring 2008, was one of the first ideas in the plan of action to be fulfilled. The task for the students was to use design to communicate less use of energy and resources. Examples of this were signs at the elevators encouraging taking the stairs instead of the elevator, and signs encouraging the opening of doors by oneself instead of using automatic door openers, Figures 1 and 2. The students also calculated the effect of the signs. In almost all cases the signs had a positive effect. This shows that such a simple thing as designing signs in a student course can change the behaviour of many people and thereby reduce energy use. The real estate company Chalmersfastigheter AB is now working further with the signs at the elevators and signs in the lavatories; the latter reminding people not to take more paper towels than needed.



Figure 1. Signs at the elevators encouraging the use of stairs instead of the elevator. Short translation of the text on the sign: “Save the world and save yourself. Use the stairs instead of the elevator. Climate changes affects us all. Small changes in our everyday life make difference. Think about saving energy. Use the stairs instead of the elevator. It is better both for you and the environment.”



Figure 2. Sign at entrances encouraging opening doors by oneself instead of using automatic door openers. Translation of the text on the sign: “Stop: You do save energy, don’t you?”

The importance of assignments like this has been discussed by others. Heimlich, who concluded that ESD campus greening is an important movement at research and educational institutions, referred to the theory that students are better educated in sustainability when the systems in which they study are made sustainable². Van Dam-Mieras and Rikers (2007) described ESD as a comprehensive concept that requires creativity, learning by and while doing, and “cross-boundary” work³. At Universitat Politècnica de Catalunya, UPC, Barcelona, environmental workshops have been organized annually, with case studies related to UPC buildings and campuses⁴. This has been a part of the “linking initiatives” at UPC, aimed to synergistically connect areas or projects at the university. At Ball State University, Indiana, USA, yearly “Green for Green” workshops have been a successful way to environmentally adapt the campus⁵. “Green for Green” was offered as a two-week summer course for faculty members.

Exhibition of environmentally adaptable techniques on campus

A variety of environmentally adaptable techniques should be visualised on campus, to increase the understanding among students, visitors and personnel that Chalmers is at the front line of environmentally adaptable technology in research and education. While Chalmers sources of technique should be favoured, commercial techniques such as windmills or solar cells can also be visualized. It should be easy to see and understand how each product contributes to a better environment.

An example from the Johanneberg campus is the solar cells present for several years. Unfortunately, this is not known to many people, also within Chalmers. The solar cells produce energy and are used in teaching situations. However, the location of the solar cells could be better not only from a visualization point of view, but also from an energy point of view. An investigation about installing more and newer solar cells is planned, for which the question of the location will be given priority. Other examples of environmentally adaptable technique planned for Chalmers are lower energy demanding lightning in conference rooms or automatic switches for turning the light off when people leave public rooms, such as lunch rooms and photo copying machine rooms.

Information

The methods of informing students, personnel, visitors and the public about Chalmers work with sustainable development are a crucial part in this visualization project. Signs can be effective, but too much information in the form of signs could make people unable to see the one they should notice. The location of signs is another important question to take into account. Information on web pages is becoming more and more important and universities such as the Massachusetts Institute of Technology has paid much attention to this⁶. The web pages about the environmental work of Chalmers are to be improved, elucidated and updated in this visualization project. This work is done together with the public relations and communications office, as it is certainly important that the information is presented in a legible way.

Electronic signs have many advantages as information media, but they are expensive and have to be updated. At Chalmers an electronic sign is located close to an incineration plant, on the Johanneberg campus. The plant, used for research and teaching, burns mostly renewable fuels and the energy produced is utilized to heat buildings on campus. The surplus is diverted into the municipal district heating system. The electronic sign shows the present use of energy on campus supplied by the plant, Figure 3a and b. The idea to inform about the low use of fossil fuels to heat campus is good, but unfortunately the awareness of the existence of the sign is low. Therefore, improvement of the sign at the plant is included in the plan of action. As a first step, the text on the sign should be changed to inform more clearly about the low use of fossil fuel to heat buildings on campus. In a second step, the location of the sign should be changed, as another location would probably be easier to see and read.



Figure 3. a) Sign showing the present use of energy supplied by the incineration plant located on campus; b) Close-up view of the sign

Chalmers Student Union and its organisations

The importance of the Student Union as an active participant in campus greening is one of the most revealing results in this study. As the Student Union has direct and well developed contacts with nearly all students, they

can affect the behaviour of the students in many ways. The significance of the students' commitment was also found in other studies in campus development⁷⁻⁹. At Chalmers the Student Union owns several organisations, such as the university bookstore and the university restaurant, both of which welcome several hundred guests each day. The best way to influence the selection of products, sold by the organisations owned by the Student Union, is through a constructive cooperation between Chalmers and the Student Union. As a result of this project about visualization of sustainable development on campus, intensified cooperation between the university restaurant and Chalmers, for example has been initiated. Several improvements in the restaurant are planned; among these is clearer and more readable information about the "Rainforest Alliance" coffee¹⁰, and advertising for the vegetarian buffet, both served at the restaurant every day. The University of California Santa Cruz and the University of New Hampshire have made efforts to establish sustainable campus food systems¹¹. The former has proposed guidelines for procurement of food, including the criteria: buy local; buy certified organic and fair trade.

The plan of action also included some other ideas, not incorporated in the groups above, but which are believed to be valuable. An example of this is the waste sorting stations placed outdoors on campus, where the waste is sorted in the fractions of combustible, glass and metal. Today there are only a few waste sorting stations, but in the future more stations will probably be bought. Qualitative analysis based on the waste sorting stations used today shows lower amounts of mixed waste, combustible and non-combustible, but that sorting of the waste could be still better. Unsatisfactory sorting of the waste is probably due to a lack of interest among people leaving waste at the stations and to incomplete information about the sorting system. This has to be taken into consideration if more stations are to be located outdoors on campus.

Future work

Finding a solution to keeping the work of campus improvement going, when the initial phase had ended, was one of the most important results of the project. During this project it was clear that the building of cooperation between all actors is most vital to success in forming a sustainable campus. Some cooperation between the management of Chalmers and the real estate companies had already existed before this project, but now it was intensified and broadened. To assure a continuation of the visualization of sustainable development on campus, a steering group was appointed. This steering group includes representatives of the real estate companies and the management of Chalmers, as well as a representative from the Student Union Board. It will be the responsibility of this group to assure that the work with campus greening will continue. One of the first tasks of the group is to formulate a common vision, to assure similar expectations and goals for the project.

At Chalmers there is another project for sustainability on campus is in progress. However, it has a wider perspective in that it for instance deals with reduction of energy use, reduction of CO₂ emissions, and changing people's behaviour to be more environmentally adaptable. The project is called "Sustainable Campus" and

involves the cooperation of the management of Chalmers and the real estate companies. The “Visualization of sustainable development on campus”, discussed here, is a part of the wider project “Sustainable Campus”. Among the advantages of this is that it is enough to have one steering group, which can coordinate and monitor all of the sub-projects; hence, the group can find and foster possible synergy effects, such as the implementation of solar cells which make sustainable development visible, while also reducing the use of fossil fuels and thereby the CO₂ emissions. The importance of cross-institutional action has been discussed earlier¹².

Environmental measures already realized on campus

The idea of sustainable development is not new, and many illustrative and effective ideas have already been realized at Chalmers. Some years ago a new student hostel was built on campus. The building was constructed by conventional methods, but with emphasis on energy efficient solutions and the use of environmentally adaptable materials. In student residence apartments in Sweden, the cost of electricity is usually included in the rent, independent of how much electricity is used by each tenant. However, in this student hostel each apartment has separate electricity bills. This provides an incentive for each student to use less energy, which results in both better economy and environment. Compared with a conventional student hostel, the energy consumption is calculated, by the environmental coordinator at Chalmersfastigheter, to be about 25 % lower in this student hostel at Chalmers. As the hostel is situated on campus, the need for transportation is low. Still, there is a large garage for bicycles to promote cycling instead of car-driving; we hope this will become a good habit when the students move on to other kinds of housing.

The minimisation of parking places on campus is a good example of redesigning of space on campus in a more sustainable way. This has been an ambition for many years; today there are far fewer parking places on campus than there were a couple of years ago. As shown in Figure 4, a central part of the Johanneberg campus, where both students and personnel pass several times each day, was covered with parking places some years ago. Not only were the risks connected with traffic and a lot of people walking there a problem, but also the emissions and the unpleasant atmosphere it created. A decision to re-build the area was made by the management of Chalmers and the real estate companies. The students were involved and they wanted to have greenery and a place for barbecuing and relaxing. After rebuilding, a safer, cleaner and more pleasant place is now available for student activities, Figure 5.



Figure 4. The car park on campus before re-building.



Figure 5. The green park on campus after re-building.

Household waste from the personnel and students' lunch-rooms is being sorted at special waste sorting stations for a couple of years now, Figure 6. The waste is sorted into the fractions of combustible waste, hard plastic packages, paper packaging, metal packaging, coloured glass and clear glass. A fraction of non-combustible waste, intended for broken drinking glasses, pottery and other incombustible waste that are not packaging, is also to be introduced. In addition to the signs on the station bins, there is also a poster to inform about the different waste fractions for sorting the waste, and the advantages of recycling. The waste is sorted by the university personnel and students themselves; the station is emptied by the office cleaners, who send the waste to the correct handling systems. The amount of waste for recycling has increased, while the amount of mixed waste has decreased since the stations were implemented.



Figure 6. a) Waste sorting station with information poster used in the lunch-rooms; b) Close up view of one of the signs.

Conferences and other events are often organized at Chalmers. Our outdoor campus is sometimes used for a variety of functions, such as the Travel and Transportation Day, which has been arranged annually the past four years for students and personnel. The Travel and Transportation Day is organized by Chalmers in cooperation with the Swedish National Road Administration and with the real estate companies. External exhibitors, such as The National Society for Road Safety are invited. The aim of the Travel and Transportation Day is to raise awareness of the internal environmental work of Chalmers. Each year the traffic day has had new themes, such as climate change, physical welfare and cycling. The themes are intended to encourage personnel and students to choose environmentally beneficial ways to travel, Figure 7.



Figure 7. The annual Travel and Transportation Day in 2007; personnel and students had the opportunity to let a bike repairman inspect their bike for free.

5. Conclusions

- The visualization of sustainable development on campus is an extensive challenge which also involves a great opportunity to implement the vision “Chalmers for a sustainable future”. To succeed both the commitment and determination of all actors involved are necessary, as well as clear guidelines for how and when different parts of the project are to be carried out and who is responsible for keeping the project moving.
- Chalmers Student Union and its organisations are important actors in campus improvement and shall therefore be active partners in the continuing work with sustainable campus development and the visualization of it.
- A steering group with representatives from the real estate companies and the management of Chalmers, which also included representatives from the Student Union, was formed. It will be the responsibility of this steering group to assure that the work with campus development continues and is improved.
- The plan of action for visualization of sustainable development should be seen as a starting point and guideline for the steering group in the continuing work.
- The project discussed in this article, “Visualization of sustainable development on campus”, is a part of the overall project “Sustainable Campus” at Chalmers. The “Sustainable Campus” has a wider focus: for example, it deals with the reduction of energy use as well as changing people’s behaviour to a less demanding way of affecting the environment. An advantage of this is that many ideas concerning visualization also are affected by other sub-projects; a common steering group for all sub-projects reduces the administrative work considerably.

This project was an initial study of the visualization of sustainable development on campus, and it is vital that this work continue to assure a sustainable future. Continuous and close cooperation within the steering group, for a long time, is necessary to enable the realization of major changes and visionary targets.

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Appendix A: Plan of action

Abbreviations

CFAB Chalmersfastigheter AB, one of the real estate companies owning buildings at Chalmers

AHV Akademiska Hus Väst AB, one of the real estate companies owning buildings at Chalmers

CSS Chalmers Students for Sustainability; an association recognized by the Student Union

GMV The Centre for Environment and Sustainability, GMV, in Göteborg

PROJECT	RESPONSIBLE/ PROCESS HOLDER	OPENING	CLOSURE
Establish structures for continued work			
Appoint a steering group, to assure the campus greening progress	Managers of each organisation	January 2008	Continuing
Increase the cooperation between real estate companies, teachers, researchers and students in relation to campus development			
Increase the use of campus as a laboratory in student education	Pernilla Ottosson, GMV (convener) Mathilda Silva, CFAB Per Löveryd, AHV	Spring 2008	Continuing
Conduct a student project within a design course, focused on behavioural change	Thomas Nyström	Spring 2008	Spring 2008
Exhibit environmentally adaptable techniques on campus			
Exhibit and use good examples of furniture and equipment, e.g. lighting systems, in conference rooms	Chalmers Environmental Coordinator (convener) Mathilda Silva, CFAB	Autumn 2008	Spring 2009
Install automatic light switch-off in public rooms, e.g. lunch rooms	Ulf Redsäter, CFAB, Jan-Erik Jarnskog, AHV, of which one is convener, Chalmers Environmental Coordinator	Spring 2008	Continuing
Increase the use of solar cells on campus	Mats Hägg, CFAB Jan-Erik Jarnskog, AHV, of which one is convener	Spring 2008	Autumn 2009
Information			
Visualize campus greening projects on the web page, www.chalmers.se	The public relations and communications office of	Spring 2008	Autumn 2008

	Chalmers		
Update the environmental information in the internal web pages	Chalmers Environmental Coordinator	Spring 2008	Continuing
Inform new students about environmental issues at Chalmers	Chalmers Student Union through Lisa Willman, CSS	Autmn 2008	Continuing to new students
Inform about Chalmers environmental diploma on the webb page, www.chalmers.se	The public relations and communications office of Chalmers	Spring 2008	Continuing when the home page is updated
Develop the electronic sign board at the power plant	AHV, e.g. Per Löveryd	Spring 2008	Spring 2008
Chalmers Student Union and its organisations			
Cooperate with Chalmers Restaurant and Conferences on environmental issues	Chalmers Environmental Coordinator	Spring 2008	Continuing
Ideas of importance, not included in the groups above			
Improve bicycle service stations	Mats Hägg, CFAB Daniel Olsson, AHV, of which one is convener	Spring 2008	Spring 2009
Visualize the greening of the building Vasa 1, where several environmental organisations and companies are accommodated	Thomas Pieschl, CFAB, is convener in the existing project group	Continuing	Autumn 2008
Start a bookstore, selling second-hand literature to students	Chalmers Student Union through e.g. CSS	Spring 2008	Continuing from autumn 2008