2008

ETH Zurich Environmental Report

Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Editorial

Beyond a doubt, CO_2 emissions are increasing on a global scale. The calculations of emissions, on the other hand, differ widely. Depending on methodology, data sources and emission factors, the results can be extremely divergent. ETH Zurich is continually refining the calculation of its ecological footprint – because only when the origin of the emissions is known, can reasonable and efficient measures be defined and implemented.

There is a great deal of potential in the area of improving efficiency, reducing losses, e.g. putting devices in standby, and especially in optimizing building technology. In heat recovery from cooling processes, we have made considerable progress since last year. The hard work of our operational staff has paid off financially as well. Every kilowatt hour obtained from heat recovery means less burning of valuable fossil fuels.

In recent years a notable trend is discernible toward more electricity consumption and less use of fossil fuels, which has also improved ETH Zurich's CO_2 balance. However, since there are also problems associated with a supply of electricity that is sufficient and environmentally compatible, also this valuable resource must be used conservatively.

The greatest CO_2 imprint, however, is not caused by our heating and cooling systems, but by our air travel. Here, we are searching for solutions that enable international exchange without significantly impacting the environment. For example, one of the projects which ETH Zurich students and employees worked on during the Ecoworks Creative Workshop in November 2008 was Trainforplane. Many innovative ideas resulted from this workshop, demonstrating the strong motivation of students and staff to make their contribution toward improving the ecological footprint.

Working together is also a theme in Science City. The ETH Campus at Hönggerberg aims not just to pioneer ecological issues, but also to take into consideration the societal and financial criteria of sustainability. The new student housing complex will be the cornerstone for a "real" campus, enabling us to cultivate the social components of living together better in the coming years.

By the way, the holistic approach of ETH Zurich will be documented even better in the future. Next year the Environmental Report will be expanded into the Sustainability Report.

Professor Dr. Roman Boutellier,
Vice-President Human Resources and Infrastructure

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Environmental Goals and Projects at ETH Zurich 2008

Burn fewer fossil fuels – buy more electric power. This trend, apparent since 2004, continues to ring true at ETH Zurich. In the future, it will be increasingly important to work on energy efficiency of building technology systems, research equipment and whole buildings.

First Minergie® building of ETH Zurich

With its first Minergie® building, HIT (Information Science Laboratory), ETH Zurich has turned over a new leaf. HIT is the first university building to be constructed with consistent emphasis on energy efficiency. This means the economical use of resources, natural operation of building structures as well as the use of renewable energies. In other words, in constructing the HIT building, attention was focused on the efficient use of all resources, with the least possible impact on the environment. The result is a high degree of spatial quality, because natural resources, such as wind and sun, have been incorporated. Mechanical ventilation systems and mechanically generated cooling and heating energy are additionally implemented to support the natural supply of energy. Consequently, the newly constructed HIT building complies with Minergie®-ECO Standards.

Optimizing operations achieves good results

Optimizing operations is an important pillar in the efforts to improve energy efficiency at ETH Zurich. In the past year, success was most notably achieved in cold production and utilization of the ensuing waste heat (see page 7). New lighting also produced significant energy savings. Improvement projects demand a great deal of commitment on all sides. The existing, well functioning operating conditions and processes must be critically probed in order to identify savings potential. What's more, besides savings in energy and resources, optimizing often leads to better operational safety.

CO_2 emissions in connection with business travel: limited options without certificates

ETH Zurich has decided not to take advantage of the offer to purchase so-called CO_2 certificates to compensate CO_2 emissions. However, to attain the environmental goal of lowering the allowable CO_2 output of all business travel and excursions 50 percent by the year 2009, it would be essential to have the possibility of compensating CO_2 emissions externally. Through internal projects alone, CO_2 emissions – especially those caused by air travel – cannot be adequately compensated. Hence the goal should probably be revised, whereupon strenuous efforts must still be undertaken to limit CO_2 emissions. The focus is on supplementary measures that lead to a reduction of business travel.

About-face in recycled paper

The introduction of white recycled paper has led to another increase in the use of environmentally friendly paper. The goal of raising the share of recycled paper to 50 percent by 2010 is therefore within reach again. Another positive note is that paper consumption per capita continues to decline. Scripts and documents are less often printed out, more often read and processed directly on the screen.

Fuel consumption remains high

Despite the success of hybrid vehicles, ETH Zurich has not been able to reduce average fuel consumption – and thus also CO_2 emissions. Without directing our attention more clearly on better management of our fleet of vehicles and focusing on newer, smaller and more efficient motorized vehicles, this target cannot be reached. A new attempt will be launched in 2009. In particular, older vehicles must be replaced, within the given budget, by new and more efficient models, and medium-term options, such as all-electric vehicles, must be investigated.

ETH Zurich key figures 2008

Employees including students (FTE*):	14,825
Energy reference area (ERA):	619,556 m²
Energy consumption electricity:	6,867 kWh/FTE/a; 164 kWh/m²/a
Energy consumption heat:	2,841 kWh/FTE/a; 68 kWh/m²/a
Water consumption:	18.9 m³/FTE; 0.5 m³/m²/a
CO_2 emissions (total):	23,669 t/a

Key:
I: Implementation
E: Extension
P: Partial success achieved
C: Completed, goal realized
C/N: Completed, goal nearly realized
R: Redefined
D: Discontinued

* Calculation of the FTE (Full-Time Equivalents) was adjusted for the year 2008. As a result, the new figures cannot be compared with those of previous years. Only the new figures are used in the report. The increase in FTE from 2007 to 2008 equals 6.3 percent.

Environmental goals ETH Zurich	Measures	2008	2009	2010	2011
Energy management In selected building complexes (where Energho contracts exist) overall energy consumption to be reduced 10 percent by 2010 (basis 2005).	→ Optimize operations via Energho in the ETL and FEL buildings at ETH Zurich. → Improve energy efficiency by optimizing chillers and lighting renovations.	P P	E E	E E	E
New buildings/Renovations The aim is to meet or exceed the Minergie®-ECO Standard in construction of new buildings. For total renovations the aim is the Minergie® standard for renovation.	→ Building opened in 2008: HIT. → Building opened in 2009: HPS. → In construction in 2009: HPL. → Renovation to begin in 2009: HPP.	C I	I I I	I I	I I
Renewable energies The share of renewable energy in overall power consumption to be increased to 1 percent by 2010.	→ New buildings in Science City are supplied with the certified green electricity "ewz.wassertop" from 100 percent renewable energy sources.	P/I	I	I	I
CO_2 emissions in business travel The allowable CO_2 emissions of all business travel and excursions to be reduced 50 percent by 2009, based on level of 2006.	→ Establish the project platform Ecoworks for internal projects to reduce carbon footprint of ETH Zurich. → Implement Ecoworks projects to reduce carbon emissions or increase energy efficiency. → Define further activities.	C	I E	I E	
Air pollution reduction The NO_x output of heating systems to be reduced from 84 mg/m³ (2004) to 60 mg/m³ by 2010. Fugitive VOC emissions to be decreased 15 percent by 2012 (basis 2008).	→ Replace old boilers in HEZ. → Replace old solvent collection boxes with new, airtight boxes by 2012.	P/I	I I	I I	I I
Waste management The proportion of recyclable materials in discarded waste to be increased 1 percent a year by 2010 (basis recycling rate 2008: 45 percent).	→ Recycling of used chemical substances via Storage Room. → Recycling of solvents. → Introduce recycling of other materials (CDs/DVDs, electronic waste, etc.).	P/I	I I I	I I I	I I
Fuel consumption of vehicles fleet The average specific fuel consumption of the fleet of vehicles at ETH Zurich to be reduced to 9.5 l/100 km by 2010. The number of kilometers driven with small, efficient vehicles (< 122 g CO_2/km) to be increased 20 percent by 2010 (basis 2008).	→ Consistent promotion of efficient, environmentally friendly vehicles. → Replace old automobiles with newer and more efficient models.	P/I	E I	E I	 I
Paper consumption Paper consumption per employee (full-time equivalent) to be decreased 5 percent a year by 2010. The share of recycled paper to be increased 50 percent by 2010. By 2010 all the paper used at ETH Zurich to be FSC or PEFC-certified.	→ Introduce white recycled paper. → Fresh-fiber paper only purchased with FSC label, quality permitting.	P/I P/I P/I	I I E	I I E	
Sustainability in education By end 2009 an overview drawn up which establishes in which lectures sustainability-related topics are taught. As of 2010 the revised evaluation method to be applied to all courses mentioned in the overview.	→ Building on existing evaluation structures at ETH Zurich, an easy-to-use tool should be developed to assess course quality, permitting the quality regarding sustainability, interdisciplinarity and professional qualifications to be measured and evaluated on the basis of a survey.		I	I	

Energy Efficiency Steadily Improves

ETH Zurich continues to grow. Energy consumption, on the other hand, is decreasing per square meter of energy reference area and per user – a positive trend that should continue in the future.

The number of students at ETH Zurich once again rose sharply in 2008; there were 796 more matriculations compared to the year before. The number of employees grew by 333 FTE (full time equivalent). For 2008 this results in a total increase of 874 FTE to 14,825, equal to a growth of 6 percent. All in all, ETH Zurich numbered 11,888 students and 9,049 employees at the end 2008.

Area growth

In 2008, in terms of ERA (energy reference area), ETH Zurich occupied 310,000 square meters in Science City, 280,000 square meters in the city center and a total of 16,000 square meters at the outstations Lindau-Eschikon and Schwerzenbach. This amounts to 30,000 more square meters than in 2007. And the expansion goes on – especially in Science City. With the opening of the university sports center, the area in Science City will exceed by far that in the city center. Construction of a new lab building (to begin in 2009) and a student residence will cause the campus to grow even more.

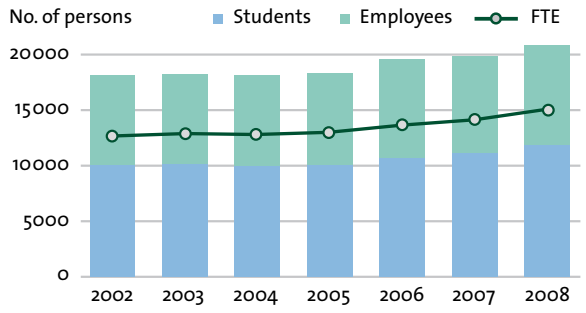
Energy consumption per energy reference area

In 2004 the specific final energy consumption reached a peak of 311.5 kilowatt hours per square meter. Since then this value has been steadily decreasing. Currently, it is 235.7 kilowatt hours per square meter, 24 percent below the 2004 value. In other words, over the past four years ETH Zurich has been continually increasing its energy efficiency. Thanks to the construction of new energy-efficient buildings as well as building renovations, this will continue to be the case in the coming years.

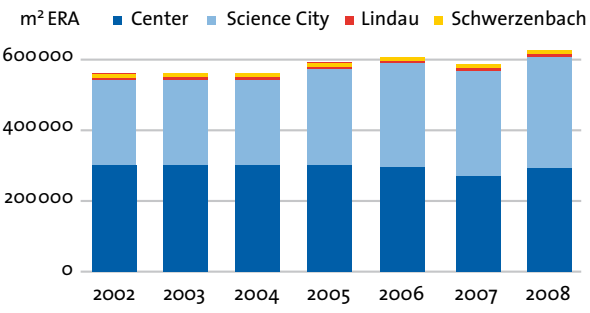
Energy consumption per user

Also the specific final energy consumption per user reached a peak in 2004: 13.6 megawatt hours. Converted into crude oil, this is equivalent to 1,360 liters a year. Since then, this value has decreased by 29 percent. Consequently, nearly one-third less energy is used per employee or student than in 2004. Besides technical improvements, this trend is also due to a reduction in space requirements (ratio of ERA to FTE), which confirms that ETH Zurich has been utilizing its facilities better since 2004.

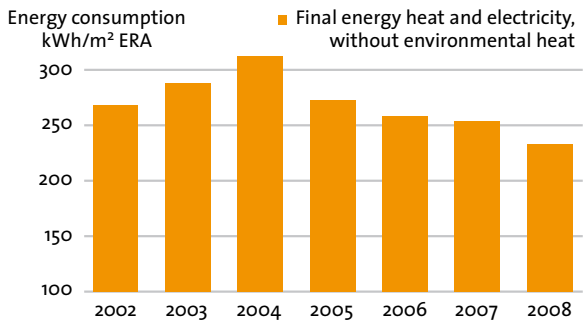
Growth in students and staff at ETH Zurich



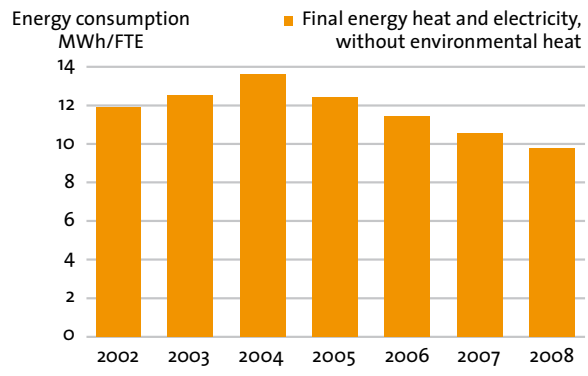
Area growth at ETH Zurich (canton of Zurich)



Energy consumption per m² energy reference area ETH Zurich



Energy consumption per user (FTE) ETH Zurich (without externals)



Five Additional Gigawatt Hours of Waste Heat Recovered

Cooling applications are increasingly in high demand at ETH Zurich. However, only a marginal quantity of the generated waste heat is utilized. Current data show that investments made in waste heat recovery are amortized in just two years' time.

ETH Zurich owns and operates seven large central cooling plants, each equipped with an average of two to four chillers. In addition to cooling, each chiller produces waste heat. This can either be optimally used via a waste heat recovery unit (WHRC) or has to be returned to the environment through a heat exchanger. The heat exchangers, usually located on the roof of a building, require additional electricity and water treated in an expensive process.

Increase in waste heat recovery

In 2008, 44 gigawatt hours of waste heat were generated at ETH Zurich. Of these, 9.6 gigawatt hours were recovered for heating purposes. This represents an increase of approximately 5 gigawatt hours compared to 2007. Because less heating needs to be purchased as a result, ETH Zurich is able to save a considerable sum of money. The ROI (return on investment) has been under two years for all the heat recovery projects conducted since 2004. It must also be stated, however, that these optimizations are highly complex and can be realized only with the concentrated efforts of staff members.

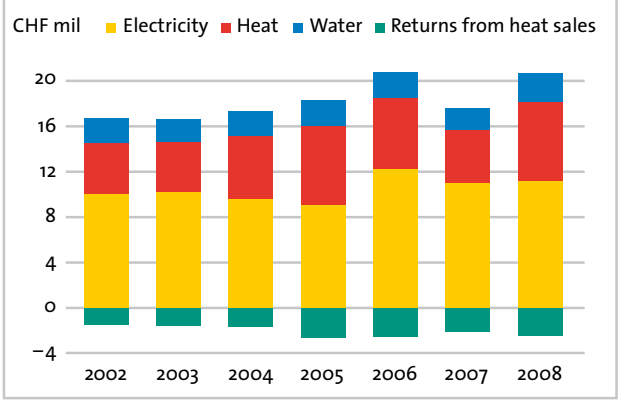
Chillers in the new Chemistry building (HCI) run very efficiently

Since 2004 ETH Zurich has been conducting consumption data analyses to determine and monitor the annual cooling quantity produced, the electrical energy required, the resulting and the utilized waste heat, as well as the coefficient of performance (COP) of all cooling equipment. It was shown that in 2008 the waste heat recovery was improved most notably in the cooling system of the HCI building thanks to the dedicated efforts of the users. 3 of the 5 additional gigawatt hours of waste heat recovered in 2008 were attributed to this system. This confirms that cooling systems should continue to be analyzed in the future in order to achieve optimal waste heat recovery.

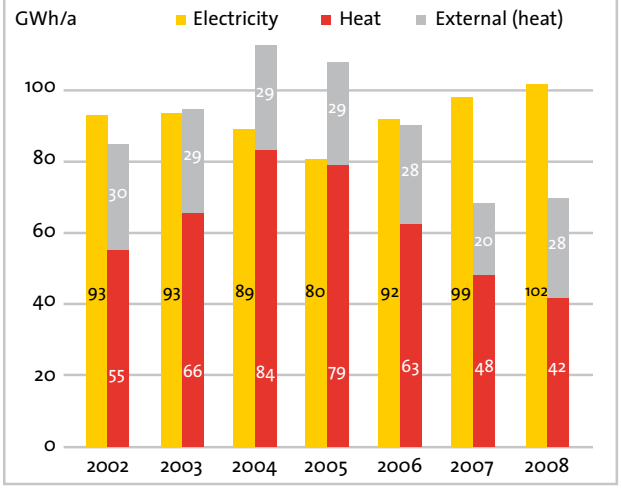
Gas prices cause soaring energy costs

ETH Zurich's heat consumption was reduced by 6 gigawatt hours compared to 2007. Consumption by external users, however, increased significantly. Due to the sharp rise in fuel prices, this has led to an added cost of approximately 3.5 million francs. The total energy and water costs are therefore at the level of 2006, namely 20.6 million francs.

Total costs ETH Zurich according to resources



Heat and electricity consumption at ETH Zurich

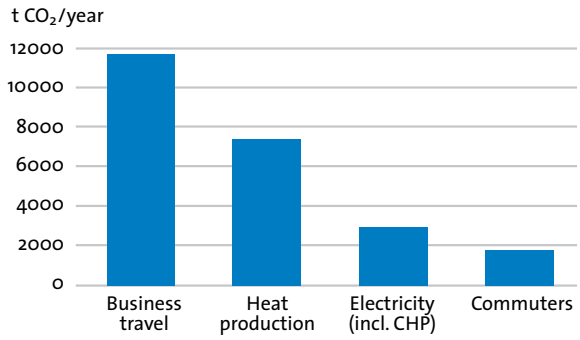


→ The Walche heat pump draws valuable energy from the Limmat River.

CO_2 Emissions in Detail

ETH Zurich emits several thousand tons of CO_2 annually, as a result of burning natural gas, oil, gasoline and diesel. In 2008 these emissions were further reduced compared to the previous year, especially those connected to heat production. Also the indirect CO_2 emissions were closely examined.

CO_2 balance of ETH Zurich 2008



In addition to direct CO_2 emissions, there are indirect emissions, over which ETH Zurich has little influence. To achieve a comprehensive CO_2 balance, analyses and calculation of these indirect CO_2 emissions are currently being undertaken. The goal is to complete the data of the CO_2 balance at ETH Zurich by including the indirect CO_2 sources. In 2009 catering is going to be under scrutiny. First estimates have shown that the production, transport, packaging, processing and preparation of food in ETH Zurich cafeterias cause substantial direct and indirect CO_2 emissions.

Heat production

The use of fossil fuels at ETH Zurich declined somewhat compared to 2007. While the ETH combined heat and power plant was used more intensively, and consequently more gas was required, operation of two conventional gas-fired boilers needed less gas. When the old inefficient gas boilers are replaced in 2009 and 2010, gas consumption should decline significantly in the future – with the same heat demand – due to the increase in efficiency. Over the coming decade, the gas-fired boilers will be replaced with geothermal energy by installing underground storage tanks in Science City, which is why the boilers will be used only for redundancy purposes until 2020 or 2025.

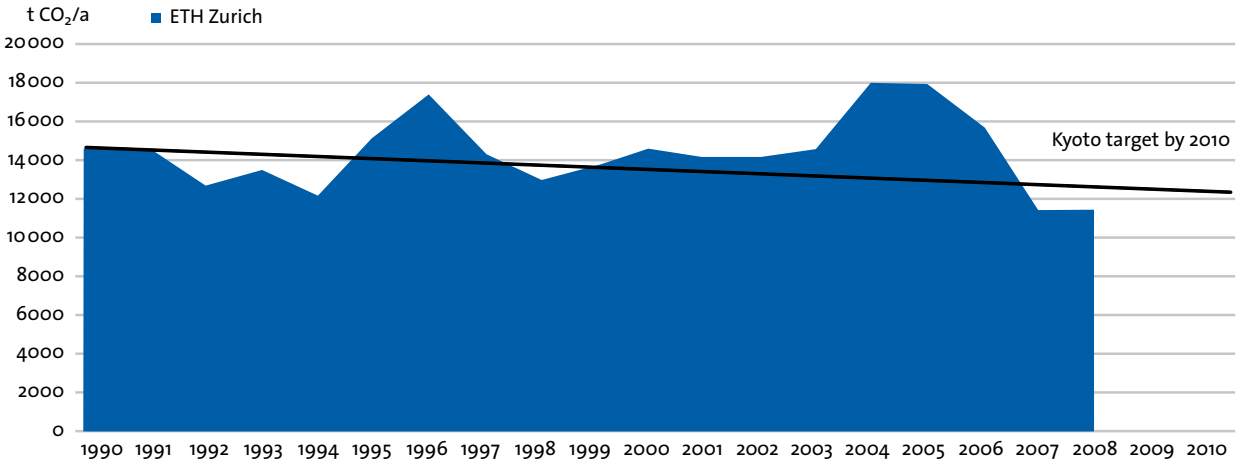
Business trips/commuter traffic

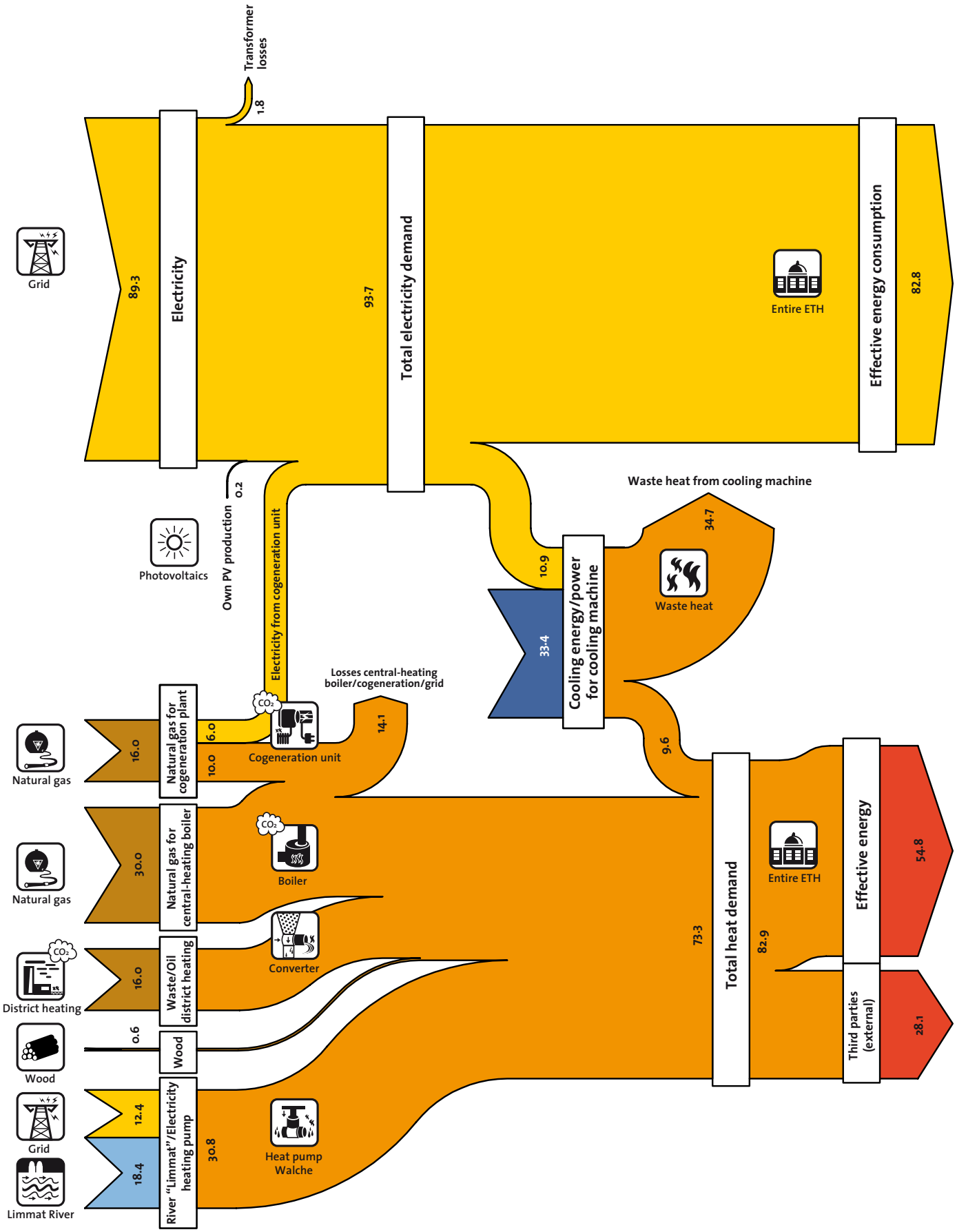
CO_2 emissions produced by business trips (air and rail travel) in 2008 remained consistent with the previous two years. A small increase was noted for automobile travel. With no major change in commuter activity expected for the year, the data for commuter traffic was not collected in 2008, but based instead on the figures from 2007.

Electricity

In 2008 for the first time, overall electric power consumption was analyzed in relation to indirect CO_2 emissions. ETH Zurich purchases electricity at its sites in the canton of Zurich, 95 percent of which is generated from hydropower and 5 percent from other renewable energies. The result is that the carbon dioxide footprint of 1 kilowatt electricity from the grid is relatively low, at less than 10 grams CO_2 per kilowatt hour.

Total CO_2 emissions ETH (Heat production)





Energy flow chart ETH Zurich,
properties within canton of Zurich (Energy date in GWh/a)

Energy Flow Chart: Tracking the Data

The comprehensive and correct compilation of energy flow data is an important instrument for planning and control. On the essential basis of consumption data, savings potential can be identified and new or optimized systems efficiently monitored. The following explanations should contribute to a better understanding of the relationships illustrated in the energy flow diagram.

ETH Zurich purchases energy in the form of electricity, natural gas, heating oil and district heat. The energy received by the customer is known as final energy. The useful energy consumed by ETH Zurich is generally in the form of electricity and heating in the university buildings. Approximately 10 percent of the purchased electricity is used to generate cooling energy. One differentiates between process cooling, for example to create laboratory cooling water, and air conditioning for cooling rooms. A small percentage of the electricity is supplied to laboratories and building services for compressed air. On the basis of the consumed useful energy, i.e. heat and electricity, savings potential can be defined and savings targets quantified.

Lost energy

Due to the maximum thermal efficiency ratio, the operation of boiler installations and combined heat and power units is always connected with losses. Additional losses occur in the extensive heat and cooling distribution networks. Waste heat from the cooling process is mainly created in summer and because of the low demand for heat must be given off to the environment largely through recooling systems. Use of waste heat, which is widely abundant also during the colder season, is complicated by its low temperature level. Particularly in older buildings, when outdoor temperatures are low, it cannot be transferred to the heating system, which operates at high temperatures, without the additional use of a heat pump.

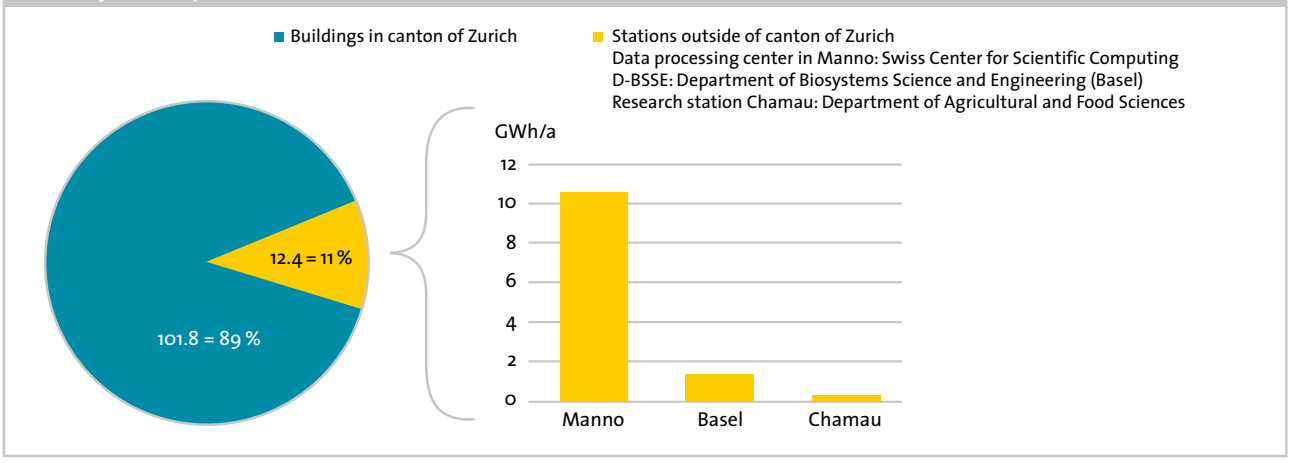
Supply to external users

ETH Zurich also supplies heat to external users (third-parties) in neighboring buildings. These external users are not associated with ETH Zurich in any way and not involved in research or education. ETH Zurich has a long history as a heat supplier and this service has grown over the past decades.

Outstations of ETH Zurich

ETH Zurich operates a small number of so-called outstations that are supplied with energy from their own facilities. The Eschikon and Schwerzenbach experimental stations in the canton of Zurich are included in the ETH Zurich energy flow diagram as well as the diagrams on page 6. The stations outside the canton of Zurich are not contained in the energy flow diagram. Some, however, are significant energy consumers and will therefore also be recorded annually and consolidated in the energy balance of ETH Zurich.

Electricity consumption inclusive outstations GWh 2008



→ The new LED lighting in the main building is very energy-efficient as well as eye-catching.

Conserving Resources and Recycling Materials

ETH Zurich advocates the closing of materials cycles wherever possible. Collected materials and waste are currently in high demand, which is why separate collection makes sense from an ecological as well as economic point of view.

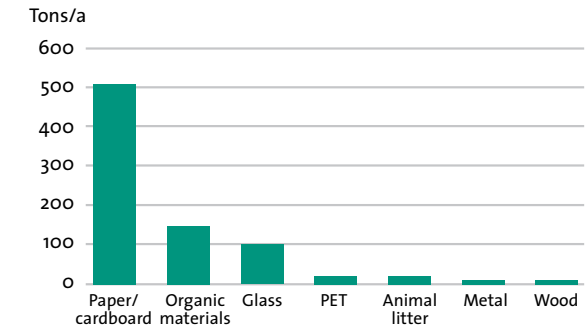
Roughly 1,847 tons of refuse were collected and disposed of at ETH Zurich in 2008. This is a reduction of 7 percent compared to the previous year. Due to systematic waste separation, the proportion of recyclable materials has increased to 45 percent. Additional materials collected separately (for example CDs/DVDs, toner cassettes) and new waste categories should further raise the recycling rate in the future. Paper and cardboard represent the largest portion of recyclable waste. At ETH Zurich somewhat more than 500 tons were collected in 2008.

Hazardous waste unchanged

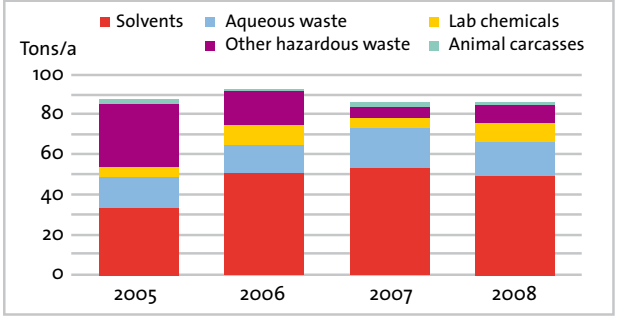
The overall quantity of hazardous waste has hardly changed from the previous year's level, stabilizing at 86 tons. The substance of hazardous waste is however composed differently. The vacating of several laboratories led to more chemicals waste. In addition, large amounts of oil emulsions were accumulated (other hazardous waste). The proportion of solvent waste was however smaller than in the previous year. Nonetheless, at 49 tons it represents approximately 57 percent of the hazardous waste.

The disposal process is clearly regulated: The SGU (Security, Health and Environment) receives the hazardous waste at the specially designated drop points in Building HCI and CNB, separates it professionally and delivers it to the proper waste facility.

Recyclable waste at ETH Zurich 2008



Hazardous waste disposal at ETH Zurich

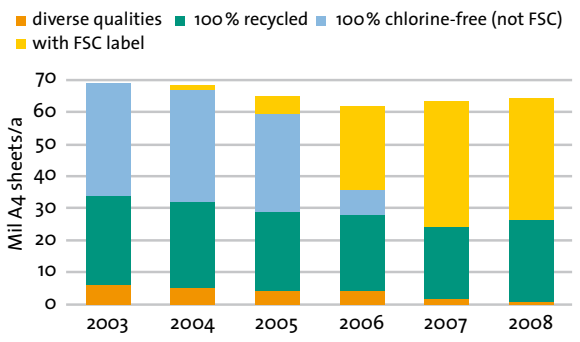


Recycled paper on the advance

Paper consumption per FTE (full-time equivalent) was reduced by 6 percent last year. This development is all the more encouraging since the share of recycled paper grew again in 2008. At 40 percent, it represents an increase of more than 6 percent. This success can be attributed to the introduction of white recycled paper, which meets the need for a high quality paper.

In the future, only recycled paper and fresh fiber paper with the FSC label will be used at ETH Zurich. The few special types of paper that do not comply with this policy will be replaced with other products over the next two years.

Paper consumption at ETH Zurich

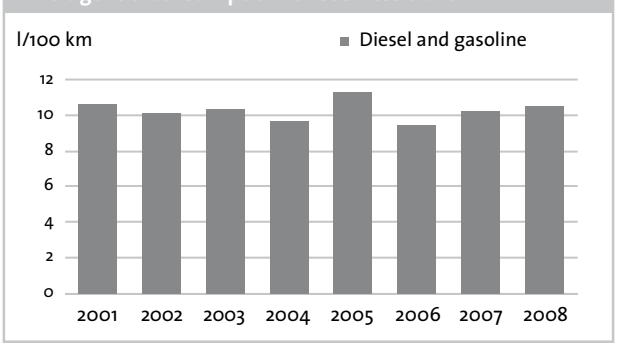


Fuel consumption remains high

The fuel consumption of the ETH fleet of vehicles was on average 10.5 liters per 100 kilometers in the year 2008. This is a slight increase of 3 percent over last year. The heightened use of larger vans and delivery trucks was to a large extent behind the increase in fuel consumption.

In 2008 ETH Zurich owned nine vehicles with CO_2 emissions below 122 grams per kilometer. About 186,400 kilometers were driven with these vehicles. This corresponds to 15 percent of the entire distance covered by the 110 vehicles in the ETH fleet in 2008, i.e. approximately 0.5 percent more than one year ago.

Average fuel consumption for business travel



The number of kilometers driven with CO_2 emissions below 122 grams per kilometer should be further increased over the next two years by adapting the fleet policy and implementing smaller and more efficient motor vehicles. As an additional measure, customers should be informed when reserving a vehicle of its fuel efficiency.

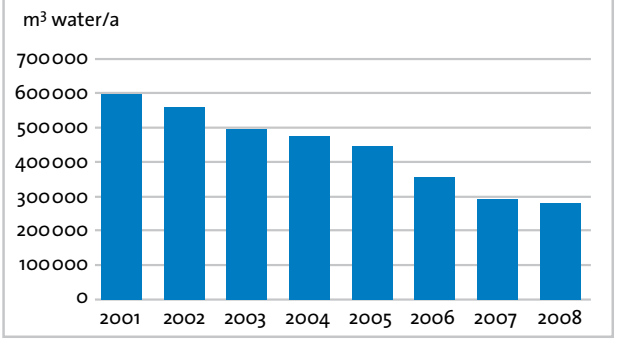
Higher costs despite lower drinking water consumption

A total of 280,013 cubic meters of fresh water was used at ETH Zurich in 2008, amounting to a reduction of 4.2 percent compared to the year before. The specific consumption was 18.9 cubic meters per FTE. Despite savings, costs have escalated. This can be explained in that the fixed costs portion included in the price of drinking water rises continually as new buildings are opened.

Drinking water will be an increasingly valuable resource in the coming years. Therefore, in order to further reduce drinking water consumption at ETH Zurich, rainwater will be used for toilet flushing or heat exchanger units in the Science City complex.

The use of partially or fully deionized water increased again in 2008. For this reason, a study is planned for 2009 which will identify for what purposes this expensively treated water is used at ETH Zurich and where there is potential for optimizing its use.

Water consumption at ETH Zurich



The New Monte Rosa Hut SAC

ETH Zurich and the Swiss Alpine Club SAC are collaborating to build the New Monte Rosa Hut, to be completed by September 2009. New trendsetting technologies in design, planning and construction of buildings are being put into practice in this project, the goal being to realize outstanding and innovative architecture. Exposed to the elements at 2883 meters above sea level, in the midst of an unspoiled and spectacular environment, the new SAC hut sets a milestone in sustainable construction.

Studio Monte Rosa – a think tank, workshop and experimental laboratory

In the winter semester of 2003/04 Studio Monte Rosa was set up as part of the course work in architecture and construction. Based on the students' design project, SAC experts, ETH Zurich professors and specialists from the building sector developed the proposal into a sophisticated construction project. The know-how of these experts ensures that the project's innovative ideas can be safely realized in face of the risks encountered at such high altitudes.

Sustainability has top priority

The energy and building technology of the New Monte Rosa Hut breaks new ground in order to achieve maximum autarchy by means protective of the environment. The lodge will be 90 percent self-sufficient, inasmuch as 90 percent of energy requirements are covered by solar energy. This energy is obtained via photovoltaic panels and supplies all of the electrical equipment. Hot water for showers, sinks and the kitchen is primarily solar-heated. Meltwater from the surrounding area covers the lodge's water needs. It is collected in summer and stored in a cavern, so that running water is available even when there is no meltwater. All appliances are designed for water-saving operation; the in-house facility for recycled waste water is used for flushing the toilet.

Energy management is an important factor in realizing this high level of self-sufficiency. The individual components are designed to save energy; an intelligent control system optimizes their interaction. Besides the prevailing climate data (temperature, solar radiation) and diverse building data (charge state of energy and water storage), additional information such as visitor and weather forecasts are fed into the system. This permits predictive controlling of the overall system, thereby significantly increasing efficiency.

The ambitious building project was made possible thanks to the generous support of numerous benefactors and sponsors.

For more information on the project:
www.neuemonterosahuette.ch

→ Visualization of the New Monte Rosa Hut.

→ “Sustainability requires no definition – it must be lived.”
Prof. Ralph Eichler, President of ETH Zurich

Sustainability Anchored Strategically

Interview with Prof. Ralph Eichler, President of ETH Zurich, and
Dr. Christine Bratrich, Director of ETH Sustainability. Text: Dr. Cornelia Bachmann.

Mr. Eichler, Ms. Bratrich, what has ETH Zurich achieved thus far in the area of sustainability?

Ralph Eichler: ETH Zurich's largest sustainability project is Science City. By using alternatives to fossil fuels on the new campus, we are achieving a massive reduction of CO_2 emissions. The Competence Center for Environment and Sustainability (CCES), launched in 2006 under the aegis of ETH Zurich, also makes an important contribution with its interdisciplinary research projects dedicated to the topic of sustainability.

Christine Bratrich: Already 20 years ago, I should add, ETH Zurich assumed a pioneering role in the field of sustainability, by founding the Department for Environmental Sciences. Teaching and research use an interdisciplinary approach. Students learn to think in systems; they concentrate not only on finding technical solutions but also look at social and economic aspects.

Is the definition of sustainability, as set down for example in the Brundtland Report of 1987, still applicable today?

Eichler: I consider definitions on the topic of sustainability generally problematic. We do not want to satisfy definitions, we want to solve problems. A major goal of sustainability must be to minimize material flows, which cause greenhouse emissions, as one example. Also, nuclear waste and incinerator ash must be disposed of safely, and attention given to sustainable recycling in the agricultural sector. Sustainability, in my opinion, is too often reduced to energy issues. Energy consumption in and of itself is not bad. But we should not consume more resources than can be replenished, and we must economize their use. Furthermore, sustainability affects urban planning. Mobility can be reduced if living, working, shopping and cultural activities take place at the same location.

Bratrich: I also believe that sustainability must be lived and that setting examples is more important than theory.

Mr. Eichler, what do you wish to achieve with the Office for Sustainability at ETH Zurich?

First and foremost, the Office should coordinate the numerous activities at ETH Zurich and avoid redundancy. It has the additional task of promoting cooperation, which certainly isn't easy. Outreach, in other words communication surrounding the topic of sustainability, should be improved with the new Office. Then, we also wish to involve students more and get their opinions on topics pertaining to sustainability.

Ms. Bratrich, what motivated you to take on responsibility for the new Office of Sustainability and what are your goals?

Bratrich: ETH Zurich is one of the most renowned technical universities in the world. People come together here from diverse fields of study and geographical regions. The combination of these factors portends a fascinating potential to develop sustainable solutions for the burning issues of our planet. This diversity of ideas and people motivates me immensely. Added to that, at ETH the topic of sustainability is anchored in their strategy and I report directly to the president. This gives me the assurance that ETH Zurich does not merely pay lip service to sustainability and that I can make a real difference. My initial goal is to attract attention to the subject of sustainability and the many exciting activities at ETH Zurich. I want to encourage more networking among the dedicated people at ETH Zurich and merge the various educational and research cultures, so that added value is created for all. Also important to me are the activities implemented directly at ETH Zurich, for example, the development of Science City, or student projects like Ecoworks.

How was Ecoworks received by the students?

Bratrich: The students are highly motivated. They receive the full support of ETH Zurich for their projects as well as the necessary appreciation. The ideas they create are not

ends in themselves; practical application is the target – for example in the cafeterias where we are trying to reduce CO_2 emissions by offering a wider selection of meatless menus.

Eichler: Another duty of ETH Zurich is to cultivate entrepreneurial thinking. An idea is worthless if it remains only theory. Ecoworks is an ideal platform for students to test their ideas in practice.

Does sustainability at a university differ from sustainability in a business enterprise?

Eichler: In principle, no. Only for us, education is added as the important pillar.

Bratrich: A university lives more intensively perhaps from the diversity of ideas. Much happens from the bottom up, not just from the top down.

Eichler: The actual goals of sustainability are however no different than in a company.

Bratrich: Our core value is that teaching exerts an influence on how people think and how they work later on. It may take 10 to 20 years of development time until this is felt and graduates begin to make important decisions connected to sustainability.

Are there areas in which ETH Zurich will be able and willing to assume a pioneering role in regard to sustainability?

Eichler: Sustainability calls for system know-how. It does not involve research that is oriented to disciplines, but involves interdisciplinary teams – widely diversified competence centers that focus on sustainability. In such forums no one topic is more important than any other. The question raises itself, however, as to how careers can be made in interdisciplinary teams and how the quality of research can be assessed. There is much to learn in such matters. This is where we can be pioneers.

What strategies and guidelines are there for research in regard to sustainability?

Eichler: The quality standards are the same as for other research. In the past it was customary to develop on one's own certain criteria for sustainability in research. But today at ETH Zurich, research in all fields is measured by the same yardstick.

Bratrich: Research should be free of constraints and guidelines. There are albeit certain incentive systems, "research funds", for the purpose of sponsoring interdisciplinary projects on sustainability.

Eichler: The incentive to solve a complex problem with others should be a top priority here. Money should not be a central issue; the ideas and vision of a research project are important. If these don't add up, there should be no monetary allocations.

Bratrich: Sustainable also means the transfer of ideas from research and education to the business world. ETH Seed Sustainability and ETH Transfer are successful vehicles for this process.

Where do you see the greatest potential for improving sustainability at ETH Zurich?

Eichler: The greatest potential lies in educating future decision-makers. We want to impart sustainability universally to all areas. We tend to forget sometimes that a good number of our modern comforts were invented by engineers: mobile phones, computers, automobiles ... And they all land sooner or later in the waste dump. So, the life cycle of a product should be considered already in the development of new technologies.

Bratrich: But this does not entail hammering sustainability into the students' heads in every course lecture. It should be naturally integrated into process thinking.

Where do you see ETH Zurich in terms of sustainability 20 years from now?

Eichler: Clear targets have been formulated for ETH Zurich. In 10 to 15 years the direct CO_2 emissions of ETH Zurich should be cut in half at least. Another topic is optimizing waste heat utilization. Computers devour enormous amounts of electricity, but the waste heat can hardly be utilized because its temperature is too low. Either we develop a low-power computer that uses less electricity, or we succeed in utilizing the waste heat more efficiently at higher temperatures. We are currently working together with IBM on a research project dedicated to this issue.

Bratrich: My dream would be to have sustainability established firmly in research and education in the next 20 years, so that special programs are no longer required.

Eichler: Sustainability will always need promotion activity because there are too many people in the world with only their own interests at heart. If we are able to convince people and get them to act sustainably of their own accord, we have accomplished a great deal. Setting an example is therefore very important, also for us at ETH Zurich.

Small Measures – Big Impact

ETH Zurich puts into practice every year a variety of small measures with the aim of sustainably reducing the environmental impact. A before-and-after look at four examples from the reporting year 2008 highlights some results of these measures.

Example 1:
Replacement of old collection boxes for solvents

Over 50 tons of waste solvent accumulate every year in the research laboratories of ETH Zurich and must be properly disposed of. These solvents are separated in the labs into chlorinated and non-chlorinated solvents and stored temporarily in collection boxes, before being pumped off into large tanks in the central disposal station. Due to vapor evacuation, the collection boxes led to relatively high fugitive VOC emissions (solvent vapors). By replacing approximately 140 of the old boxes over the next years, these emissions can be radically reduced. A closed-loop process in the new system prevents solvent effluents from evaporating to the environment.

Example 2:
Retrofitting vans with diesel-particle filters

ETH Zurich comprises over 200 different buildings. It is therefore not surprising to find a great deal of to-and-fro between the individual buildings. Many of these transports pass through the heavily congested inner city of Zurich. For this reason ETH Zurich has decided to retrofit its delivery vans with particle filters. Since 2008 six vans have been driving "particle-free" from A to B. For the innovative filters made of sintered metal with 99 percent efficiency, specialists have devised an active process that regenerates the filters clogged with carbon particulate in any operating state. As soon as an optimal amount of carbon-particulate matter has been accumulated in the filter, the active regeneration starts the burn-off. This process is ideal for short distances and stop-and-go city traffic.

Example 3:
Commuting from building to building on electric scooters

Operational staff frequently need to commute between the many buildings of ETH Zurich. Until now, they have used conventional motor scooters. In an experiment introduced in 2008, Mobilec electric scooters, which are noiseless and absolutely free of emissions, have been zipping through the city streets. This year the results of the pilot test should reveal whether the product has proven itself and whether more electric scooters should be purchased. On level terrain, the ecological scooter has a range of approximately 30 kilometers. If the battery can be charged in daytime during working hours as well as during the night, they can do up to 60 kilometers.

Example 4:
New lighting: more light with less energy

The main-stairway lighting of the physics building HPH needed replacing in 2008. Instead of conventional lighting fixtures, the newest generation of halogen-metal halide lamps was installed. Such lamps can convert up to 38 percent of the energy used into visible light and have a lifetime of up to 30,000 hours on electronic ballasts. The result is an annual savings of approximately 40,000 kilowatt hours, with an increased light output as well. This corresponds to about the same amount of electricity supplied over a period of two years by the new photovoltaic system on the HIT.

Ecoworks: Shaping Sustainability

Ecoworks, the internal platform for enhancing ETH Zurich's environmental performance, brought forth many creative projects in 2008. Students, employees and faculty contributed ideas and know-how, and now are also involved in implementing the projects.

In November 2008 over 100 members of ETH Zurich and other interested parties came together at a special event in an unused building at ETH Zurich. Many of them probably had only a vague idea of what a meeting, called Ecoworks Creative Workshop and lasting more than twenty-four hours, would entail. But the objective was crystal clear: together they would develop ideas for concrete projects to reduce the CO_2 emissions of ETH Zurich and to improve energy efficiency.

Supported by an integrative moderation technique, the participants were highly motivated to make their contributions from the start. In sessions on networking and domain mapping, they first had a chance to become acquainted with one another and the various topics. During the subsequent "idea market", project groups were formed in which ideas were discussed, debated and developed, late into the night. The next afternoon 17 project proposals were presented and are now in the process of being implemented.

Ecoworks – initiative for the environment

Ecoworks was launched in 2008 at the initiative of two students. The administration supports this innovative idea, which will now be carried forward by ETH Sustainability and the ETH Environmental Officer.

The focus of Ecoworks is on practical, implementable projects which affect energy efficiency and CO_2 emissions at ETH Zurich and in the environs of the ETH community. Also supported are projects that contribute to raising awareness and smaller research and development projects that will lead to optimized products and processes in the near future.

Ecoworks is open to students from all departments as well as to employees in research and infrastructure domains. Through their participation in Ecoworks, students gain practical experience in project work, wherever possible as part of their studies, in the form of a semester, bachelor's or master's thesis.

Further information: www.ecoworks.ethz.ch
In addition to a brochure, a short video on the workshop is available for downloading.

Project Testimonials

Sustainable conference

In the framework of a semester paper, Annina Brunner and Franziska Elmer examined ways to organize a sustainable conference. Using the example of the Annual Meeting of the Alliance for Global Sustainability (AGS), they took a closer look at the topics of transportation, meals, accommodation and printing. The outcome is a checklist intended to facilitate sustainable conference organization.

Eat less CO_2

The aim of this project is to sustainably reduce the consumption of meat in ETH cafeterias by making vegetarian menus more appealing and through selected menu changes. The combined effects could lead to an annual CO_2 reduction of 520 tons, which corresponds to approximately 2 percent of total ETH emissions.

ecoworks

Ecoworks projects

✔ Improved Printing System

Improved Printing System
Economizing print resources

Eat less CO_2

Eat less CO_2
CO_2-optimized menus in ETH cafeterias

trainforplane

trainforplane
Incentive system to alter travel behavior

Publica - Low Carbon Fund

Publica – Low Carbon Fund
Optimizing investments of ETH pension fund

Energy Paparazzi

Energy Paparazzi
Exposing crimes against the environment

ecoAct

ecoAct
Developing student awareness of their own actions

water-heat-exchanger

water-heat-exchanger
Heat exchanger for waste water

Akanthus

Akanthus
Real-time life cycle assessments of ETH Zurich

Choose Stairs — not Lift!

Choose Stairs – not Lift!
Awareness campaign for elevator use

Inno-Rain Project

Inno-Rain-Project
Drinking water conservation

[re]CYCLING

[re]CYCLING
Using energy from ASVZ sports equipment

windows lab
overnight shutdown

windows lab overnight shutdown
Consistently shutting down computers not in use

human dynamo

human dynamo
Utilizing the energy of stepping on floors

ENValuate

ENValuate
Web-based tool to identify alternatives

figure of your lifestyle

figure of your lifestyle
CO_2 calculator and ways to reduce CO_2

SunWindProject

SunWindProject
Solar and wind energy systems on roofs

integrated
Energy Production

integrated Energy Production
ETH Zurich draws all its energy from renewable sources

Innovation Leads to Energy Efficiency

ETH Zurich faces great challenges in 2009. Once again on the ecological agenda are numerous measures aimed at reducing CO_2 emissions and improving energy efficiency. ETH Zurich plans to give even more attention to the theme of sustainability in the future.

In energy consumption a visible trend is manifest: ETH Zurich is burning fewer fossil fuels, which has a positive effect on the CO_2 balance. The use of heat pumps has electrified heat production to a greater degree: today, as a means of waste heat recovery (for example from cooling equipment) and environmental heat from the Limmat River – tomorrow, for the systematic use of geothermal heat within the framework of the Science City energy concept. ETH Zurich has long been preparing these measures for the reduction of direct CO_2 emissions. The target for the next 10 to 15 years is to cut the present direct CO_2 output by at least half. This is possible only through a rigorous strategy for the renovation of older buildings and a future-oriented energy policy. The future goal is to supply both ETH campuses with the most efficient and environmentally friendly energy possible.

Higher server capacity – greater electricity consumption

Electricity consumption has risen consistently in recent years. There are several reasons for this. Besides the increased use of heat pumps to generate heat, the unrelenting energy requirements of ever larger servers have undoubtedly contrib-uted to the expanding demand for electricity. The demands on computer performance and capacity will continue to escalate at ETH Zurich in the coming years. In designing and planning such systems, energy efficiency (electricity requirements for the server and cooling as well as the possibility of waste heat recovery) must be prioritized. Very promising in this context are the latest developments in high-performance computers that enable generating waste heat at an interesting level of over 50 degrees Celsius. This would greatly facilitate the recovery of what was formerly “lost” energy and permit new methods of waste heat utilization.

Promoting innovation on campus

ETH Zurich is unique in Switzerland in terms of innovative potential. Many benefits derive from innovations that can be directly implemented on the ETH campus. For instance, these can take the form of pilot projects in the area of power supply, application of state-of-the-art building technology or other environmental technologies. But smaller projects as well, such as those conducted by students or employees, can also contribute significantly to making the ETH campus a flagship university for innovation in the realm of sustainability. An example of this is the current project in which students are investigating how conferences at ETH Zurich can be held in a more sustainable manner. Other highly promising projects are in preparation (energy concept for Science City, building technology lab or Ecoworks projects) and are awaiting realization.

ETH campus sustainability report

Sustainability is not just defined by ecological parameters. Social and operational aspects, as well as sustainable education and dialogue with the general public are equally important cornerstones of a sustainable university campus. To give all these factors due consideration, as of 2010 the environmental report of ETH Zurich will be expanded into a sustainability report in cooperation with ETH Sustainability.

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