



## People Are Our Key to Success

Science is never an end in itself. In the ETH Domain in particular, world-class research and education is ultimately focused on creating value for society. Our drive to push the limits for sustainable development benefits people, in developed economies and in developing countries.

The ETH Domain sees people as key to its success. This includes its motivated undergraduate and graduate students – the leaders of tomorrow – as well as its dedicated faculty and staff, on whose excellence our scientific achievements are based. The illustrations throughout this international edition of the ETH Board Annual Report 2006 focus on people and the exciting projects to which they contribute at the ETH Domain's six institutions.

**Page 4/5** | Dr. Faustin Kamena is a biochemist involved in the work on the malaria vaccine in Prof. Seeberger's group at ETHZ. Originally from Cameroon, he studied biochemistry at the University of Tübingen, Germany, followed by a PhD at the Max Planck Society, also in Tübingen. (Project description: p. 16/17)

**Page 12/13** | Dr. Tania Rinaldi received her PhD in neuroscience in 2006 from EPFL. Her experimental findings on microcircuit composition and connectivity contribute to the data basis of the Blue Brain project, an initiative to reverse-engineer and simulate the human brain. In 2007, she will begin a postdoctoral research position at Harvard University's Department of Molecular and Cellular Biology. (Project description: p. 18/19)

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**Page 28/29** | Karel Samec is an Australian of Czech parentage. He attended Calvin College in Geneva before coming to ETHZ to study mechanical engineering. He worked on the Ariane 4/5 and Airbus A340 projects and is now involved in the development of high-powered liquid metal neutron spallation sources at PSI. (Project description: p. 20/21)

**Page 38/39** | Dr. Marcus Schaub is head of the research group for Forest Reactions to Atmospheric Changes at WSL. He received his PhD in ecophysiology in 2001 from The Pennsylvania State University, USA, after graduating from ETHZ. Complementing his research, Dr. Schaub acts as a translator for forestknowledge.net, an international platform on forest ecology and management. (Project description: p. 22/23)

**Page 42/43** | Empa doctoral student Olle Sundström studied electrical engineering at Chalmers University of Technology, Sweden, and the University of Michigan, Ann Arbor, USA. Since August 2006, he has been working on the design and control systems for the natural gas hybrid concept at Empa and ETHZ. (Project description: p. 24/25)

**Page 48/49** | Caroline Stengel is a technician at Eawag working on understanding the geochemistry of arsenic in groundwater in Southeast Asia. Ms. Stengel is part of a multinational team of faculty, students and technical staff committed to improving the quality of life for people in the developed and developing world. (Project description: p. 26/27)

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ETH BOARD – ANNUAL REPORT

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## +++++ Strategic Goals

### **The ETH Domain bases its planning on clear strategic priorities given to the ETH Board by the Swiss Federal Council.**

As an integrated system of two large research universities and four targeted national labs, the ETH Domain receives the majority of its funding from the Swiss Confederation. This funding is based on the recognition that the ETH Domain is a world leader in science and engineering research and education, securing a place for Switzerland at the global forefront of knowledge and innovation advances.

The ETH Board and the Swiss Federal Council set strategic priorities in four-year planning increments. This enables a balance between the continuity needed for successful program development and the flexibility needed to address emerging needs in a dynamic social and economic environment.

#### **Priorities outlined in the 2004–2007 performance mandate are as follows:**

- The ETH Domain boasts internationally recognized world-class teaching.
- The ETH Domain consolidates its position as a leader of international research.
- The ETH Domain creates attractive working conditions.
- The ETH Domain defines and promotes promising subject areas.
- The ETH Domain strengthens cooperation with other Swiss universities.
- The ETH Domain promotes the innovative strengths of Switzerland due to the increasing technological and economic application of its knowledge.
- The ETH Domain strengthens the role of its institutions in society.

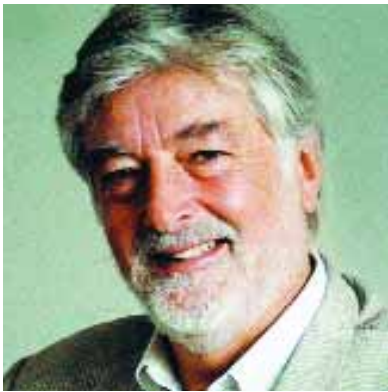
These priorities provide the strategic context for the 2006 activities at the ETH Domain discussed in this report. With the motto “Pushing the Limits,” the 2008–2011 strategic planning roots the ETH Domain’s long-term vision in the support of sustainable development. Within this overarching vision, it highlights the creation of knowledge in science and technology, the education of the leaders of tomorrow, and the successful competition and collaboration with other globally leading academic institutions. More details on the 2008–2011 strategic planning are provided on pages 32–33.

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+++ ETH Zurich, Malaria Vaccine Development





"We create value for society."

FOREWORD

**Dear Reader**

The ETH Domain is an innovation engine for society and economy. In exchange for our funding from the Swiss Confederation, our network of two universities and four national laboratories must demonstrate that we address society's pressing needs and train effective leaders for tomorrow. We must strike a constant balance between creative academic freedom and social accountability. Some see this requirement as limiting. We from the ETH Board take a different view, and see accountability in our research agenda and our operations as a booster of innovation.

A commitment to a sustainable future is a blessing rather than a burden for research and teaching. For us sustainable development is intergenerational justice. It poses three simultaneous challenges: safeguarding our planet's life support systems; helping developing countries improve their standards of living; and maintaining and increasing the quality of life already achieved by prosperous countries such as Switzerland. Research and education can only address this triple challenge successfully by transcending

disciplinary boundaries and their accompanying paradigms. We firmly believe that the most exciting advances in science and engineering happen beyond such boundaries. Therefore, Competence Centres are an essential part of our strategic planning, linking researchers across disciplines and institutions, particularly on issues of energy and mobility, environment and sustainability, materials science and technology, systems biology, and biomedical imaging. The Competence Centres are gateways that facilitate collaboration between industry, society, and research on emerging national and global hot topics.

Our strategic planning 2008 to 2011 is the basis for the next performance mandate agreement between the Swiss Federal Council and the ETH Board. The process initiated by the framework described in our strategic planning will allow us to push the limits for developing the basis of sustainability, to create value for society, and to strengthen the funding and governance foundations of the ETH Domain. It is not only our high standards in research and teaching that enables this work, but also our unflinching commitment to ethical practice in all our activities. We have to 'practice what we preach',

including supporting justice and equity in our research agenda and operations, and being accountable in our leadership.

While we have made strides this past year in pursuit of a sustainable future, we have also faced challenges. In the application of ethical practice to our research agenda, the ETH Domain has begun to assume a globally leading role in research and teaching for a '2,000 Watt Society'. This is a vision in which innovations in the energy field enable equitable access to energy services for all global citizens, while still protecting the global climate. However, in terms of equity in our own operations, we are still falling short with respect to gender balance, especially in senior faculty positions. But we are encouraged that the leadership of Eawag, one of our six institutions, was assumed by a woman, Janet Hering, in 2006. As a former professor at the California Institute of Technology and executive officer for its Keck Laboratories, Hering brings a wealth of experience to the Domain. Lastly, the early resignation of the president of ETH Zurich was one of the most difficult moments in 2006. The resignation of the leader of a world-class academic institu-

tion always creates consternation and uncertainty. But such a transition is also an opportunity for constructive reflection. After an intense, often tension-filled search process, the ETH Board has finally found an ideal successor for the presidency at ETH Zurich. Ralph Eichler, hitherto director of the Paul Scherrer Institute, will assume his new position as president of ETH Zurich on 1 September 2007. The ETH Board has also successfully completed a second search process that was started in 2006. On 1 August 2007, the Swiss Federal Institute for Forest, Snow, and Landscape Research (WSL) will finally have a director at its helm once again. James W. Kirchner is leaving the renowned University of California, Berkeley in order to take the lead at WSL, a fact that underlines the excellent international reputation of the ETH Domain and its institutions. With such a reputation, and with new leadership firmly in place, I am certain that all institutions of the ETH Domain can now turn toward the future with both invigoration and confidence.

people benefit from an excellent infrastructure and an attractive location. Switzerland is consistently ranked among the world's top regions for quality of life, and Swiss society is exceptional in its ability to support collaboration between people with different languages and cultural backgrounds. The ETH Domain is a powerful partner for international collaborations in research and education – and a competitor to be reckoned with.

Alexander J.B. Zehnder, mid-July 2007

The ETH Domain is poised for success as an institution among world leaders in research and teaching. In fact, we already hold leading positions in international rankings. Our outstanding

## +++++ Overview of the ETH Domain and Board

The ETH Domain is a coherent and coordinated group of six Swiss research and teaching institutions dedicated to excellence in science and engineering. The Domain receives the majority of its funding from the Swiss Confederation, and is accountable to the Swiss Federal Council via a performance mandate agreement between the ETH Board and the Federal Council.

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### OVERVIEW OF THE ETH DOMAIN AND BOARD

- The two large research universities in the Domain are based one each in the German- and French-speaking parts of Switzerland. Strengthening the innovative foundation of Swiss society and economy through their research, these institutions are educating leaders for tomorrow.
- The four national laboratories are focused on topics essential for economic success and sustainable development of Switzerland and the international community. They work closely with the two research universities through a variety of collaborations, including dual appointments of professors.
- In addition, Competence Centers link expertise across disciplines and foster collaboration within the ETH Domain and beyond.
- Strategic oversight of the ETH Domain is the responsibility of the ETH Board.

### **ETH Board (Board of the Swiss Federal Institutes of Technology)**

The ETH Board is the strategic unit elected by the Swiss Federal Council to manage the ETH Domain. It defines the domain's strategic direction and allocates the funding provided by the Swiss Confederation to the six institutions.

### **Research Universities**

- **ETH Zurich** is a science and technology university with an outstanding research record. Eighteen thousand people from eighty nations study, research, and work at ETH Zurich. About 350 professors in fifteen departments research and teach mainly in engineering sciences and architecture, system-oriented sciences, and mathematics and natural sciences.
- **EPF Lausanne** has a campus of more than 10,000 people and focuses on stimulating collaboration between students, professors, researchers, and entrepreneurs. These daily interactions give rise to new and groundbreaking work in science, technology, and architecture.

### **Research Institutions (National Laboratories)**

- **Paul Scherrer Institute (PSI)** makes important contributions toward managing our energy resources in a manner that is safe, sustainable, and environmentally friendly, and is one of the world's leading user laboratories for the scientific community.
- **WSL** is dedicated to forest, snow, and landscape research. Its goals are to find ways to sustainably manage landscapes and forests, and to handle natural hazards, such as avalanches, that typically occur in mountainous regions.
- **Empa** is a materials science and technology research institution. Its key research areas are nanotechnology, adaptive materials systems, materials for health and performance, materials for energy technologies, and technosphere-atmosphere.
- **Eawag** is an aquatic research institute committed to an ecological, economical, and socially responsible management of water – the primary source of all life. Its research, teaching, and consulting bridge world-class science with practical application.

## +++++ 2006 in Review

2006 was a year of accomplishment in research, teaching, and outreach for the ETH Domain, and involved some key transitions regarding organization and operations. The following are just a few examples to give a flavor of developments at the Domain in 2006.

Prof. Janet Hering  
elected as new director  
of Eawag

2006 IN REVIEW

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Launch of Competence Center Energy and Mobility (more on the new Competence Centers: p. 36)

A European Internet portal launched by WSL on forest information including storm risks reaches 1,000 articles from seven countries

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Empa's newest developments in industrial X-ray computer tomography are showcased in the ETH Domain contribution to Europe's leading industrial fair in Hanover

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ETH Zurich researchers  
develop novel method to  
detect anthrax  
(see p. 16/17)

The Swiss Light Source  
(SLS) at PSI, used by  
researchers from universi-  
ties and industry as a  
gigantic microscope,  
celebrates five years of  
successful operation

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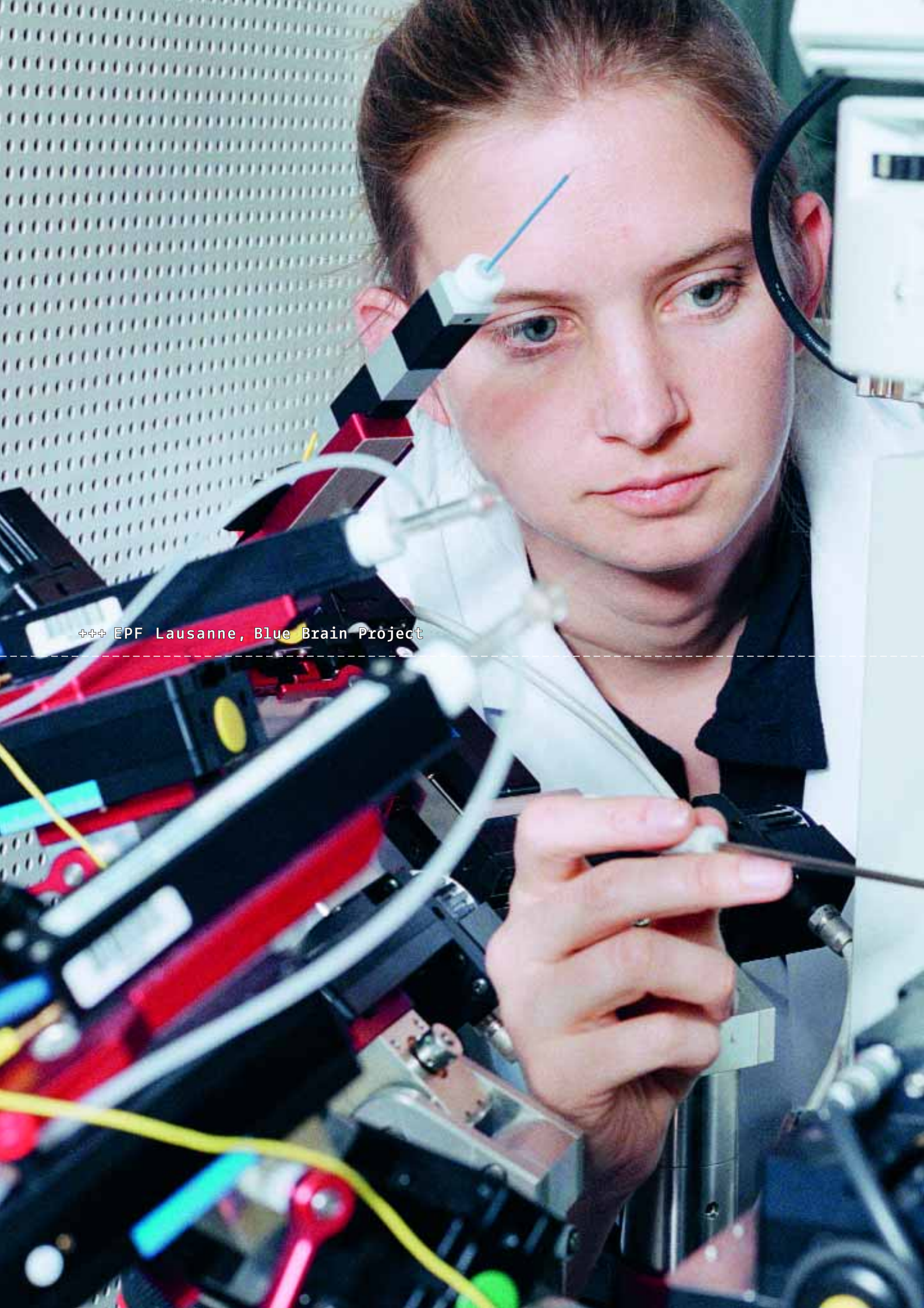
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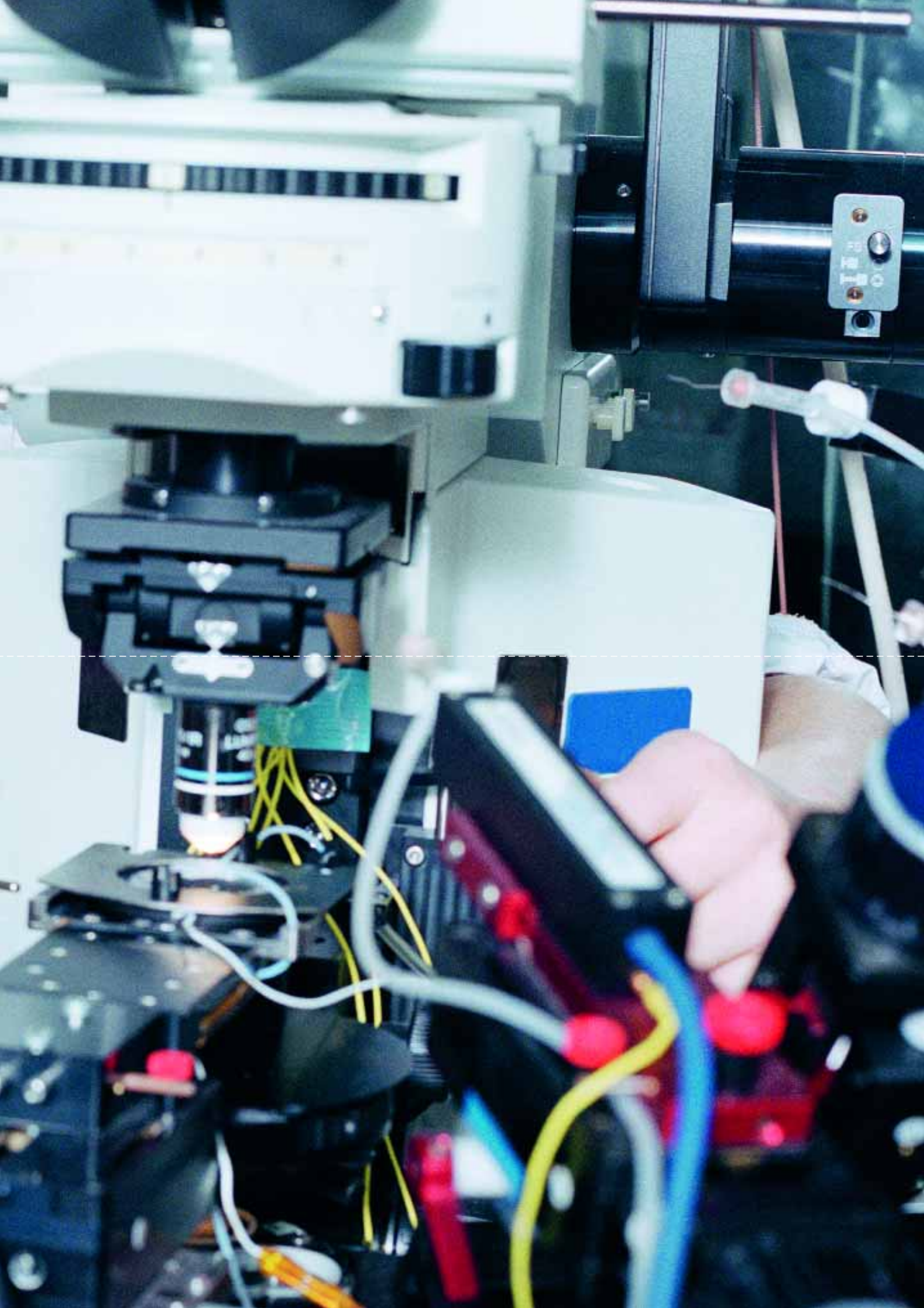
Opening of new zero-  
energy headquarter of  
Eawag (see p. 26/27)

EPF Lausanne Professor  
Michael Graetzel wins  
the 2006 World  
Technology Award

Prof. Konrad Osterwalder  
assumes the interim  
presidency at ETH Zurich  
(see p. 41)



+++ EPF Lausanne, Blue Brain Project



## +++++ Collaborative Research in the ETH Domain

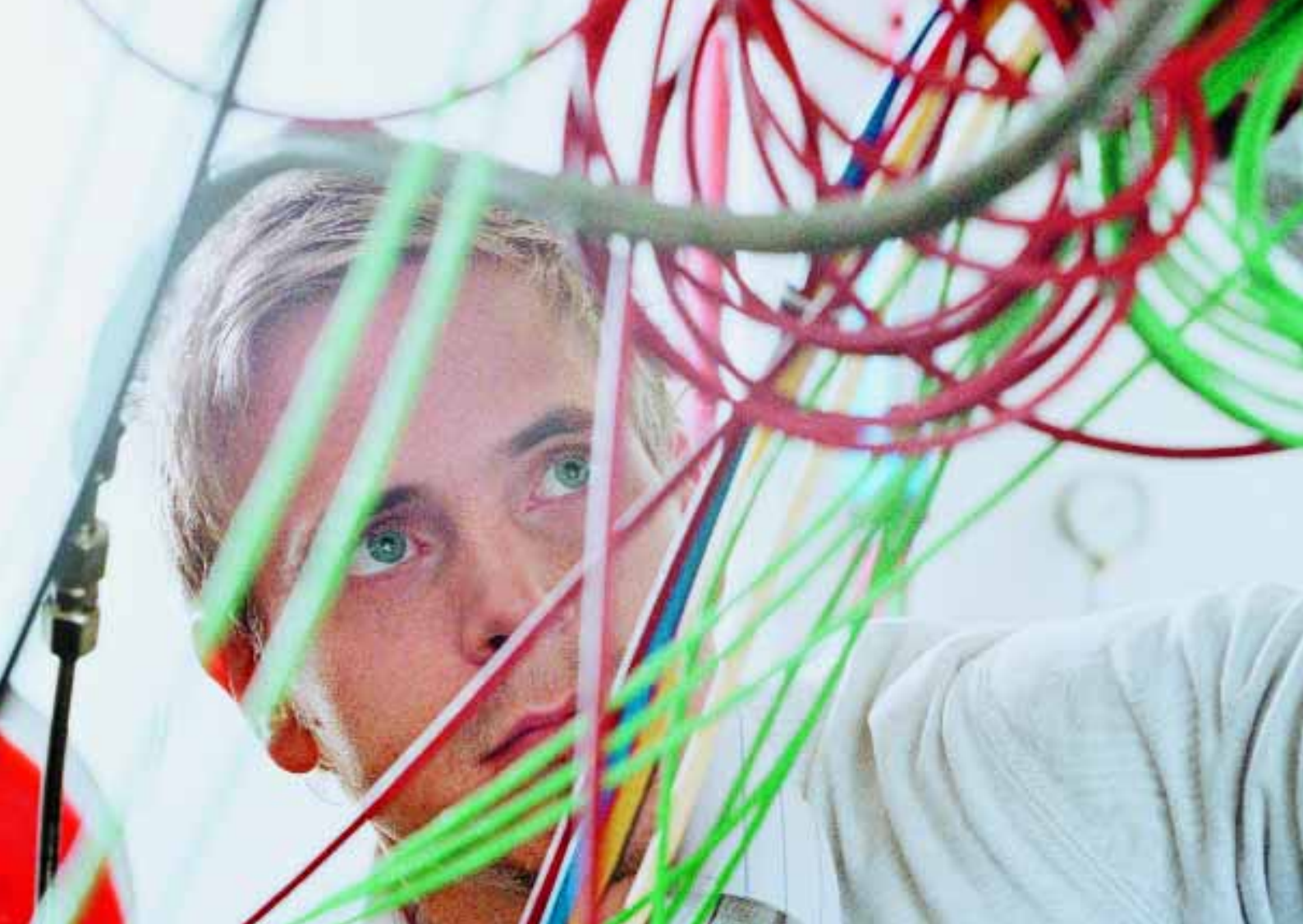
As ETH Domain researchers know well, in order to find robust and actionable solutions for the most vexing problems facing the world, many great minds must work in concert.

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### COLLABORATIVE RESEARCH IN THE ETH DOMAIN

Collaboration is the key to great discoveries. To paraphrase the famed nutritional scientist Werner Kollath, “Much is known . . . but unfortunately not all in one head.” The faculty, scientists, engineers, and students of the ETH Domain have long recognized the value of collaborating across disciplines, across institutions, and across national and international boundaries. No one person can possess all of the knowledge necessary to solve the most pressing problems faced by society. However, when many creative minds are applied to a particular challenge, much progress can be made.

ETH Domain researchers have a long history of collaborative research activities. An examination of the research portfolios across the ETH system reveals novel research and education partnerships between academia, governmental agencies, the private sector, and nongovernmental organizations. The research activities described in this report are only a small sampling of the breadth of engagement researchers from the ETH Domain have with the national and international research community. Quality cannot be achieved by working alone; collaboration and strong networking are essential. The institutions of the ETH Domain believe that creating and sustaining partnerships with national partners (the universities and universities of applied sciences) and global leaders are important tasks in this regard. Indeed, strong links with the leading European and U.S. universities, as well as with the top institutions in Asia – particularly China and India – already exist and are predicted to develop further.



From the laboratories of the ETH Domain have come great discoveries, including new ways to improve the human condition, novel approaches to facilitate commerce and maximize the efficiency of industry, and critical strategies for protecting and preserving planet Earth and its vital life-support systems. These are only possible through the cross-fertilization of ideas and the transfer of knowledge between people, teams, institutions, and countries.

The ETH Domain takes great care to lead by example and teach its students the value of interaction. Its students are the next generation of leaders in academia, government, industry, and civil society. It is at the core of the ETH Domain's mission to equip them with the best tools available and to enable them to be effective and responsible partners in research and education.

The ETH Domain is comprised of some of the most respected research and education institutions in the world. Its students have assumed positions of leadership in government, industry, and society, and have contributed to many great discoveries of the past century. Much of its success can be attributed to its active participation in international collaborations throughout its history.

### SUGARS AND THE FIGHT AGAINST ANTHRAX AND MALARIA

Anthrax has recently gained prominence as a potential weapon in biological warfare and terrorism, while malaria has long been a persistent health issue in tropical regions. These two health threats are very different, but research in rapid synthesis of long-chained sugar molecules conducted at ETH Zurich has begun to play a key role in mitigating the dangers they both pose.

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#### COLLABORATIVE RESEARCH IN THE ETH DOMAIN

A group of researchers working at the Laboratory of Organic Chemistry at ETH Zurich has developed new technologies for rapid and reliable synthesis of long-chain sugar molecules, so-called oligosaccharides. This research has broken new ground not only in the detection of anthrax and malaria pathogens, but also in the development of vaccines against them.

Anthrax is an increasing global threat due to its potential use as a biological warfare and terrorism agent. A large-scale release into a civilian population would pose grave risks to those exposed. In such circumstances, fast and reliable detection of anthrax infection would be critical, as treatment within 24–48 hours of exposure significantly increases the chances for survival.

While fast detection and treatment for anyone exposed is critical with anthrax, treatment for malaria exposure must begin with its youngest victims. Adults infected with malaria can often cope with the toxic effects of the parasites. But infants and small children are unable to produce sufficient amounts of toxin-blocking antibodies, frequently resulting in the child's death. In Africa alone, a child dies from malaria every twenty seconds. If an "anti-toxin" vaccine, similar to the sugar-based meningitis vaccine, was available for malaria-infected infants, it would not eliminate the infection itself. But it could mitigate the most deleterious effects of malaria and drastically reduce the incidence of infant death from this pathogen.

Oligosaccharides may play a key role in preventing the spread of these diseases. Like many pathogens, malaria and anthrax

cells have highly characteristic carbohydrate molecules on their surface, which can be used to differentiate them from other often-harmless parasites, bacteria, or spores. In the case of anthrax, the team collaborated with the Swiss Tropical Institute in Basel and Bern University. Since isolation and purification of sufficient quantities of the cell surface carbohydrate from the deadly anthrax spores is not possible, the group at ETH Zurich relied on chemical synthesis to access this important target. Using the synthetic sugar in conjunction with monoclonal antibody technology, the team was able to elicit a specific immune reaction in mice, and the resulting antibodies were able to detect anthrax spores rapidly and with complete specificity. Most importantly, this immunological test took just minutes – a critical feature for securing immediate treatment for victims of anthrax infection. Encouraged by earlier success in developing an antitoxin malaria vaccine candidate, the ETH Zurich team is also pursuing a potential anthrax vaccine candidate using this same synthetic carbohydrate as the basis.



The basis for these advances is the ETH Zurich team's ability to precisely and rapidly synthesize complex oligosaccharide molecules that are unique to the pathogens. While automated sequencing and synthesis of polypeptides (proteins) and polynucleotides (e.g., DNA) have enabled technologies for the modern biotechnology industry for a number of years, carbohydrates were not accessible in a similar manner. The group at ETH Zurich created

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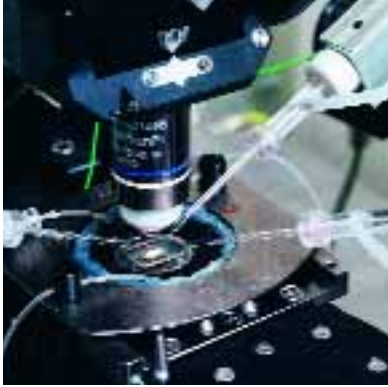
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the first automated system for rapid and precise oligosaccharide synthesis, reducing the time needed for this complex process from more than a year to less than a day.

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The team's ongoing work on diagnostics and vaccines now spans all stages from basic science to preclinical development, and encompasses collaborations with enterprises of varying sizes, including a start-up company in Boston. This brings the international collaborations of the team full circle, as the research started out at MIT before the team relocated to ETH Zurich in 2003, where it was able to translate its early methodological work into functioning automated oligosaccharide synthesis and a range of biological and medical applications.

A breakthrough in automated synthesis of long-chained sugars by researchers at ETH Zurich has resulted in new diagnostic tools for detecting pathogenic agents such as anthrax, and is the basis for developing vaccines against severe diseases such as malaria.



### MODELING THE BRAIN WITH SUPERCOMPUTERS

EPFL and IBM are partnered in a revolutionary project to computationally model the circuitry of the human brain. This endeavor has the potential to reshape our understanding of how the human brain works and to deepen our understanding of the origins of human behavior and disease.

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COLLABORATIVE RESEARCH  
IN THE ETH DOMAIN

In 2005, EPFL and IBM embarked on an exciting new research initiative: a project to create a biologically accurate, functional model of the brain using IBM's Blue Gene supercomputer. This is the first time that such supercomputing power has been dedicated to fundamental brain research. The project, which builds on the efforts of the Brain Mind Institute, promises to shed new light on the inner workings of that most complex organ, the human brain, and possibly provide therapeutic insights into a wide variety of neurological and psychiatric diseases.

As a complex organ whose functioning defines the very essence of our being, the human brain is the focus of much scientific research. The human neocortex the largest and most complex part of the human brain constitutes 80% of total brain volume. The basic building blocks of the neocortex are the neocortical columns (NCCs) – roughly cylindrical structures containing approximately 10,000 interconnected neurons each. Nearly a million NCCs make up the neocortex, defining its basic function as a micro-circuit in the brain. To understand the neocortex, it is thus essential to first understand the composition, distribution, and interconnections of the neurons that make up a single NCC. Neurons come in a variety of shapes and have varying electrical properties. Decades of laboratory data on the spatial distribution of the various neuron types in the NCC, as well as their density and electrical properties, have provided essential information needed to position and construct the foundation of the cortical circuit. Each neuron is connected to thousands of its neighbors at synapses –

the points where their dendrites or axons touch. In a column with 10,000 neurons, this translates into trillions of possible connections. Therefore, in order to simulate the activity in the neocortex, the interactions of nearly a million biological "circuits" must be modeled quickly and efficiently. The Blue Gene computer system is well suited for the extremely intense calculations required to determine the synapse locations, "jiggling" individual neurons in three-dimensional space in order to find the optimal connection scenario.

Because the structure of the NCC varies little from species to species, the basic difference between the brain of a man and that of a mouse lies in the number of NCCs; humans have many more neocortical columns, and thus more neurons, than mice. For this reason, the first goal is to build a replica of an NCC that is accurate on the cellular level, using the neocortical column of a two-week old rat as a model. There is much quantitative data available about this system, so once the circuit is built, it can be tested rigorously. As of December 2006, one year into the project, a biologically accurate 10,000-neuron neocortical column with 30 million dynamic synapses has been successfully built, and simulations are being run on the Blue Gene. Once the biological parameters of this initial computational model are fine tuned to the satisfaction of the team, it will be expanded to include neurons and connections from other brain regions, from animals of varying ages, and from different species including, ultimately, humans.

To run simulations, all 8,192 processors of the Blue Gene supercomputer are pressed into service. They engage in a massively parallel computation that solves the complex mathematical equations that govern the electrical activity in each neuron when a stimulus is applied. Currently, the time required to simulate the circuit is about one hundred times longer than the actual biological time simulated. The Blue Brain team is working to streamline the computation so that the circuit can function in real time. The system currently occupies the floor space of about four refrigerators, and has a peak processing speed of 22.8 trillion floating-point operations per second (22.8 teraflops), making it one of the most powerful supercomputers in the world.

In the future, molecular and genetic information will be added to the algorithms that generate the individual neurons and their connections, and hence to the construction of the circuits. The simulations can then be used to explore how and why certain microcircuits in the brain malfunction – thought to be the cause of psychiatric disorders such as autism, schizophrenia, and depression – or to determine what happens when there is genetic variation in particular neurotransmitters or when the brain's molecular environment is altered via drugs.

The Blue Brain project, a partnership between EPFL and IBM, is an example of basic research that leverages the best that academia and industry can offer. Through this project, there is great promise that new insights into the structure and function of the human brain can be uncovered.

**HIGH-EFFICIENCY PRODUCTION OF NEUTRONS FROM THE WORLD'S MOST POWERFUL PROTON BEAM**  
The Megawatt Pilot experiment (Megapie) is an international effort to greatly increase efficiency in the production of high-intensity neutron beams from high-power proton beams. In this landmark experiment, PSI researchers and their international collaborators demonstrated how a high-intensity neutron source could be produced from approximately one megawatt of proton input. The important applications of this discovery include determining structures at the atomic level and potentially mitigating problems of long-lived nuclear waste.

COLLABORATIVE RESEARCH  
IN THE ETH DOMAIN



Due to their unique properties, neutrons are indispensable particles for research. Atomic structures and dynamics, as well as biological substances, can be investigated with these atomic building blocks. A typical example is the analysis of the structure of materials to elucidate the mechanism of high temperature superconductivity. Similarly, they can help in understanding the molecular origins of illnesses.

Until now, experiments designed to produce neutron beams from proton inputs involved the collision of proton beams with solid metal targets. Unfortunately, solid targets are limited in how much energy they can tolerate and dissipate, thereby limiting the strength of the proton inputs that can be utilized. However, theoretical calculations showed that liquid targets, with their greater potential for efficient convective removal of the massive heat generated by the proton impact, could possibly produce far greater neutron fluxes. Capable of generating the world's most powerful proton beam, the SINQ spallation neutron source served by the ring cyclotron at PSI was the perfect facility to test this theoretical work in a real-world experiment.

In the Megapie experiment, the proton beam was focused onto a liquid metal target consisting of 920 kg of liquid lead-bismuth encased in a steel casing. A stream of high-energy neutrons was then knocked off or "spallated" from this target.

This experiment not only offered the first successful demonstration of this technology, but the system developed was capable of generating a neutron beam 80 percent more intense than had

been previously produced using conventional methods. The Megapie team also accrued a design database for liquid lead-bismuth targets, gained experience operating such a system under the conditions of present-day accelerator performance, and validated the design through extensive monitoring of its operational behavior. Future goals include a postirradiation examination of the target's components.

In addition to applications in research, high-energy neutrons can be used to "feed" a subcritical nuclear reactor system where the highly radioactive byproducts of nuclear energy production, such as neptunium, plutonium, americium, and curium can, in principle, be transmuted into far less dangerous, shorter-lived, or even stable elements. This potential to essentially "incinerate" nuclear waste, removing these dangerous materials from the waste-stream of energy production, has attracted intense international interest. While practical application is still a long way off, the information provided by Megapie is an important milestone in developing this promising technique for the nuclear power industry.

PSI's wide expertise was an important support for the Megapie project team, which coordinated the entire project including responsibilities for: selecting materials and technologies, setting operational parameters, simulating hydraulics, neutronic performance, and production of radionuclides in the target, and licensing and overall quality assurance. PSI's central role lay in the development of instrumentation and sensors to monitor the ope-

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rational parameters and provide a redundant safety system, allowing for instantaneous shutdown of the beam if problems with the target arose.

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The Megapie project is a perfect example of the power of international collaboration. Over 170 researchers from national and international research centers and companies in Switzerland, France, Korea, Japan, Italy, Latvia, Germany, the United States, and Belgium participated in this € 50 million project.

In a highly international collaboration, PSI harnessed the power of the world's most powerful proton source to generate a high neutron flux. This achievement enables advances in structure determination at the atomic level, and is an important milestone in the goal of transmuting nuclear waste into shorter-lived, or even stable, matter.

## ADVERSE OZONE EFFECTS ON TREES: UNDERSTANDING A GLOBAL THREAT TO ECOSYSTEM HEALTH

In industrialized countries around the world, ozone ( $O_3$ ) has become one of the most pervasive and harmful pollutants in the lower atmosphere. It has significant impacts on human health and is responsible for adverse effects on the health and vitality of plants. Understanding the long-term impact of ozone on the health of forest ecosystems is an area of active and ongoing international research collaboration at the Swiss Federal Research Institute WSL.

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### COLLABORATIVE RESEARCH IN THE ETH DOMAIN

The WSL ozone research efforts are part of the institute's Forest Ecosystems Processes unit. This cross-disciplinary group of researchers investigates the long-term effects and resulting risks of natural and anthropogenic stresses on forests. By analyzing data from a network of selected study sites, they monitor the long-term response of forest ecosystems to prevalent stress factors. In particular, their main focus is on the impacts of atmospheric pollution and deposition, biogeochemical cycles, and climatic conditions on the forest soil and vegetation. Of the various pollutants studied, tropospheric ozone is examined most closely.

The WSL Lattecaldo research facility in southern Switzerland is an internationally established research and training platform located in a "hot spot" of high ambient ozone concentrations in central Europe. Since 1995, this facility has played a central role in understanding the impact of tropospheric ozone on Swiss and other European forests. This work has occurred in collaboration with partners across Europe and beyond, including the Pennsylvania State University (USA), and with support of the Swiss Federal Office for the Environment (FOEN). The results from this research are highly relevant to the establishment of air quality policies throughout Switzerland, Europe, and the industrialized world.

A key outcome from these research efforts is the recognition that ozone exposure can have broad, systemic impacts on plants. The intensity of effects mainly depends on methods of atmospheric transport and stomatal uptake. Thus ozone risk assessments should not only take atmospheric ozone concentrations into

account, but also the influence of atmospheric conditions and soil moisture on stomatal conductance and nonstomatal ozone deposition. The research showed that ozone impacts include a reduction in growth rate as well as visible leaf injury, though the degree of these effects depends on species, age, and health of the trees affected.

An international collaboration between the WSL, the Pennsylvania State University, and the University of British Columbia (Canada), the Ozone Injury Web site ([www.ozone.wsl.ch](http://www.ozone.wsl.ch)) catalogues the broad variety of visible ozone-induced effects on plant life. This interactive database allows international researchers and ecosystem scientists to search for specific types of ozone-induced injury by a variety of parameters, including plant form, species, country, region, originating research project, and validation status. The database contributes to international knowledge exchange by providing researchers with detailed descriptions and high-resolution digital images of ozone-induced injury on a wide variety of plant species. By harnessing the power of interactive Web technology, this project leverages the experience of a global pool of plant biologists, ecosystem scientists, and database experts to further our understanding of the impact of this ubiquitous pollutant.

Ozone research at the WSL engages the European and the broader international community in its efforts. Its work with the United Nations Economic Commission for Europe (UNECE) is one



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such example of this collaboration. WSL collaborative projects include: Ozone-South West, studying ozone concentrations and ozone effects across Europe; IMPROVE – Improving Monitoring Protocols for Ozone effect assessment on forest Vegetation in Europe; LATO<sub>3</sub>FLUX, investigating the ozone risk assessment based on the ozone flux (i.e. uptake) approach; and Large-Scale O<sub>3</sub>, an UNECE proposal under development that builds upon the experience from Ozone-South West. All seek, in international collaboration, to leverage the collective WSL knowledge base and apply it to other locales and ecosystems.

WSL researchers play a central role in the International Co-operative Programme on the Assessment and Monitoring of Air Pollution Effects on Forests, operating under the UNECE Convention on Long-Range Transboundary Air Pollution (LRTAP). This multinational effort is a coordinated program assessing the health of Europe's forests. Approximately 6,000 observation plots mapped out on a systematic, transnational 16 x 16 km grid, as well as a network of approximately 800 intensive-monitoring plots across 40 countries allow direct measurement of a variety of parameters characterizing natural and anthropogenic impacts on forest ecosystems.

The WSL works with partners around the globe to study the impact of tropospheric ozone pollution on trees, which is an increasing threat to ecosystem health and forestry production.

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### CHARTING A PATH TOWARD CLIMATE-NEUTRAL MOBILITY

Consumer preference for car use shows no sign of abating in developed economies, and car use as a primary mode of transportation is increasing sharply in transition economies, such as China. Reconciling these consumer choices with the need to protect the global climate is driving the global demand for renewable fuels and their concomitant technologies. Renewable fuels also offer a way for many countries to meet their goal of becoming less dependent on foreign oil. Empa is working on advanced power train concepts suited for such fuels.

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#### COLLABORATIVE RESEARCH IN THE ETH DOMAIN

Around the world, researchers, consumers, and decision-makers alike are discussing fuel strategy. The primary goal of these efforts is not only to lower CO<sub>2</sub> emissions, but also to lessen our dependence on oil-exporting regions. While most western countries are committed to a long-term transition toward hydrogen-based fuels derived from renewable sources, it will be many years before that vision is realized. Practical, intermediate steps are needed. Taking into account technological as well as socioeconomic factors, transitioning to renewables-derived hydrocarbon fuels may be the most practical first step.

Renewable hydrocarbon fuel can be derived from a wide variety of biomass sources: household or agricultural organic waste; specially produced "energy crops" such as canola, sugar cane, or sugar beets; or unused wood. In Switzerland alone, the energy potential of usable biomass is estimated at 100 PJ per year. Biomass energy sources should be used as efficiently as possible. For this, a combination of electricity production and mobility applications is most appropriate. In the case of mobility, biomass can be converted into liquid ethanol, diesel-type fuels, or gaseous methane fuel, the latter of which is the focus of a project at PSI.

Acre for acre, arable land can produce four times more gaseous methane fuel than biodiesel. Methane fuel is thus a promising biomass-based fuel for mobility applications. In addition, it offers a seamless transition for the consumer: biomethane can be blended at an increasing percentage over time with natural gas fuel already available in many regions, thus achieving a smooth

transition. In terms of emissions, natural gas already emits less CO<sub>2</sub> per energy unit than petrol-based fuel, and the biomethane portion of the fuel is essentially carbon neutral.

To realize the full potential of biomass-based fuels for decreasing our climate impact, car engine technology needs to be optimized for methane use. The natural gas-powered vehicles currently available are typically based on technology originally developed for petrol-based fuels. For that reason, a series of projects initiated by researchers at Empa's Internal Combustion Engines Laboratory study different aspects of the optimization of drivetrains for methane use. These projects were undertaken in cooperation with ETH Zurich's Laboratory for Aerothermochemistry and Combustion Systems and ETH Zurich's Measurement and Control Laboratory, and were conducted with the research and development departments of Volkswagen and Bosch.

In a first step, an ultralow-emission natural gas drivetrain concept was developed by Empa and ETH in the Clean-Engine Vehicle (CEV) project. In a vehicle with this drivetrain, CO<sub>2</sub> emissions were reduced to 30% below those of a similar petrol-fueled car, and nitrogen oxide emissions were lower in the exhaust gas than in the intake air. Achieving these simultaneous reductions allowed the improved drivetrain to remain below the Euro-4 emission limits while also meeting the strict California limits for Super-Ultralow-Emission-Vehicles (SULEV). The key factors in achieving these successes were the development and realization of a downsized

engine concept, a dedicated calibration of engine electronics with integration of new control functions, and an adaptation of catalyst technology for the specific needs of methane fuel use. Knowledge gained from this project was then used by Empa to apply an optimized exhaust aftertreatment system on three prototype vehicles. Since 2005, these prototypes have been demonstrated to the public in the "Pilot Region Basel" program of "Novatlantis – Sustainability at the ETH Domain." This field test showed that the conversion efficiency and the aging behavior of this catalytic converter were significantly improved despite a strong reduction of noble-metal content in the coatings.

The CLEVER project of Empa and ETH is the next step in this research story. It will develop a methane drivetrain that improves energy efficiency by 20% over the state-of-the-art natural-gas cars, and a reduction of 40% of CO<sub>2</sub> compared to engines running on petrol-based fuels. This drivetrain will also have such low locally active emissions that it will meet the proposed Euro-5 emission limits, which are still under discussion. These targeted improvements will likely be realized through the development of a new combustion process that features methane direct-injection and controlled turbocharging, as well as a hybridization of the power train by complementing the internal combustion engine with an electric motor.

In cooperation with ETH Zurich, Empa is developing implementation-oriented low-emission propulsion technology for cars running on natural gas or biogas. This research will have significant benefits for both climate protection and air quality. Close collaboration with leading industrial partners will enable these benefits to reach the global marketplace.



### A BIOSENSOR TO HELP DEVELOPING COUNTRIES DETECT ARSENIC

Eawag is an international leader in aquatic sciences, with deep expertise in environmental risk analysis and transport of natural and man-made pollutants. Arsenic is a natural pollutant of particular concern in south and, more recently, southeast Asia. Its presence in drinking water sources is one of today's largest-scale public health crises.

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#### COLLABORATIVE RESEARCH IN THE ETH DOMAIN

Already a public health crisis, the problem of arsenic in water supplies in developing countries became even more dire with the discovery of arsenic-laced groundwaters in Vietnam. The international health community took this discovery very seriously, even before public health impacts started to appear in 2002. The Contaminant Hydrology Group at Eawag and their international collaborators are working with the Vietnamese government and representatives of the international aid community to develop core methods to help prevent a catastrophic epidemic like the one experienced in Bangladesh, where millions of people suffer from arsenicosis, the devastating illness caused by systemic arsenic poisoning. In Vietnam, approximately 11 million people are exposed to drinking water polluted by arsenic, at levels sometimes 10 to 30 times higher than what is considered acceptable by the World Health Organization (WHO). Determining which water sources are safe and which are not is the first step in preventing serious health damages. However, conventional methods for precise analysis of arsenic are costly and require advanced instrumentation.

Eawag researchers, in collaboration with partners from the universities of Lausanne and Hanoi, recently developed a protocol for a biosensor capable of detecting arsenic in water and tested it under typical local conditions for the first time. The results from the new test are significantly more reliable than those of chemical test kits previously used in the field. This biosensor uses a genetically engineered strain of *Escherichia coli* specifically designed to

produce a luminescent protein, luciferase, when it encounters dissolved arsenic. As the intensity of the luminescence is proportional to the concentration of arsenic in the groundwater sample, this luminescence can be used to determine pollution levels. This inexpensive technology permits rapid analysis of large numbers of samples and can be employed in regions of the world that do not have widespread access to sophisticated laboratory equipment.

In addition to detection methodologies, Eawag research teams are developing and testing methods to treat arsenic-contaminated water and render it safe for human consumption. At household and communal water treatment scales, different absorbent materials are being evaluated for their arsenic removal efficiency. At the urban supply level, the Hanoi drinking water plants currently use aeration and sand filtration for iron and manganese removal in the pumped groundwater. Eawag collaborative research has shown that although this technique can eliminate 50 to 90% of arsenic from the raw groundwater, which is sometimes sufficient to make the water safe for human consumption, arsenic reduction can be significantly improved by adding an oxidation agent to the production lines.

Eawag research is intrinsically multidisciplinary and places a strong emphasis on collaboration and partnership. Research teams incorporate the perspectives of not only biologists, engineers, and social scientists, but also of specialists and decision-makers in the private and public sector and in professional associations. Once

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solutions to particular challenges are identified, they are thoroughly examined to ensure that they are matched to the technical capabilities and infrastructure in the regions where they may be employed. Only through such multidisciplinary, multisectoral, and collaborative approaches will robust solutions to the world's environmental challenges be found.

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To help minimize health impacts from arsenic-contaminated groundwater in Vietnam, Eawag and the universities of Lausanne and Hanoi have developed a rapid, reliable, and inexpensive biosensor to determine the safety of drinking water supplies.



+++ PSI Würenlingen, Megapie Experiment



### A STRONG VISION, FOCUS, AND GOALS

The strategic planning for the period 2008–2011 is based on a vision of the ETH Domain contributing to a more sustainable world through its work, knowledge, and values. The process also focuses on how the ETH Domain can create value for society and how it can strengthen its institutional and financial foundations in order to support this goal.

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STRATEGIC PLANNING  
2008–2011

The near-term priorities for the ETH Domain, as outlined in strategic planning 2008–2011, form the basis for the performance mandate agreement between the ETH Board and the Swiss Federal Council for this period. The strategic plan is based on three pillars: fulfillment of a long-term vision of sustainable development, creation of value for society, and the strengthening of the ETH Domain institutionally and financially.

The ETH Domain has formulated its mission around building a more sustainable future for all. Increasing the standard of living in prosperous countries such as Switzerland, supporting the U.N. Millennium Development Goals for improving the living conditions of the world's poorest, and protecting our planet and its life-support systems are cornerstones of the ETH Domain's work on sustainable development. Accomplishing this facet of the mission requires ambition. ETH Zurich, EPF Lausanne, and the Domain's four research institutes are, at present, among the best in the world, but considerable efforts will be needed to stay competitive. Partnerships with national and global leaders will be essential.

Per its mission, the ETH Domain is focused on creating value for society. The different institutions of the ETH Domain contribute to this by expanding scientific knowledge, advancing technology, translating discoveries into innovations, and educating and training future leaders. Central to this is delivering the highest quality education for its students. However, the rate at which the educational and societal paradigms are changing continually

requires new ways of learning. Creating solutions for increasingly complex problems presupposes the ability to think in a transdisciplinary, systems-oriented, and entrepreneurial manner. The old model of learning – pure information transfer – will have to give way to problem- and case study-based learning, and to working in a multicultural context.

The ETH Domain's excellence in fostering innovation is equally important. The new Competence Centers that bundle the Domain's innovative strengths on Energy and Mobility, Environment and Sustainability, and Materials Science and Technology will play an essential role. Other initiatives that contribute to the Domain's innovative capabilities relate to Systems Biology, Biomedical Imaging, High-End Computing, High Brilliance Short Pulse X-Ray Investigation of Molecular Dynamics, and the Swiss Design Center. In these and all its other fields of innovative research, the ETH Domain's contributions to economic stability and growth will increasingly involve public-private partnerships (PPP).

The ETH Domain must increase its institutional and financial strength in order to fulfill its ambitious mission. Guided by the principles of good institutional governance, the Domain will aim to keep its management structure focused and efficient in order to strengthen the autonomy of its institutions. Creating transparency and trust are the key communication objectives within the ETH Domain. This communication imperative will be enabled by the creation of a common brand for the whole ETH Domain – a

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step that will foster a collective spirit across the institutions and make their common values and goals more visible.

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The institutions of the ETH Domain rank among the best in the world, competing and collaborating successfully with other global leaders in education and research. With its outstanding reputation, the ETH Domain will continue to attract the top Swiss and foreign students, postdocs, and faculty members looking for the highest quality in science, technology, and education. Together, these strengths will help the Domain fully realize its potential for innovations that will meet the pressing needs of both the Swiss and global societies.

## +++++ Innovation and the ETH Domain

The ETH Domain has taken a leadership role in helping to facilitate innovation in Switzerland. New knowledge and technologies must be developed and their economic potential maximized in order for Switzerland to maintain its competitiveness in the global marketplace.

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### INNOVATION AND THE ETH DOMAIN

Increasing stresses on natural resources and societies around the globe must be met with technical, economic, and social innovations if the quality of life is to improve for more people. The institutions of the ETH Domain have been key drivers in the development of these innovations, equipping Switzerland with the knowledge and conceptual tools needed to address these challenges. The ETH Domain has deeply impacted the industrial landscape of this country and has laid the foundation for the success of many companies, leading to the creation and stabilization of jobs. Through its programs and activities, ETH Zurich, EPF Lausanne and four research institutes that together comprise the Domain have helped create a highly educated workforce that keeps the Swiss economy competitive.

The ETH Domain educates at the highest academic level virtually all engineers and architects and approximately 40% of the students in natural sciences in Switzerland. In addition, the bulk of publicly funded engineering research at this level is carried out by the ETH Domain. Both ETH Zurich and EPFL Lausanne, as well as the ETH Domain research institutes, are important international players in scientific research and technology development. As a result, the ETH Domain has assumed a leading role in science and technology policy, development, and reindustrialization in Switzerland. In doing so, it boosts the entrepreneurial spirit of its students and creates a culture of global competitiveness.

One method of assessing the economic impact of the ETH Domain is to compare it with the impact of the eight research universities in the area of Boston, Massachusetts, in the United States. The Swiss Institute for Business Cycle Research (KOF) at ETH Zurich has determined that the ETH Domain produced 5 licenses, 7.1 patents, and 1.25 start-ups in 2003 per 1,000 collaborators. In comparison, the Boston area institutions generated 5.7 licenses, 5.4 patents and 0.84 start-ups per 1,000 collaborators. A 2006 study by KOF also demonstrated that the ETH Domain's research focus (basic research vs. applied research) does not influence the propensity for patenting and spin-offs. A focus on basics research seems to be quite compatible with licensing activities. This study, in fact, supported the hypothesis that basic research is not compromised by commercialization activities. The ETH Domain clearly can fulfill its mission for research and education while simultaneously fostering collaboration and innovation between the academic and private sectors.

The ETH Domain has concentrated its resources and enhanced its strength by creating Competence Centers and implementing major initiatives with substantial strategic value for Swiss society and the economy. Competence Centers at the Domain level are designed to bring together the best scientific talents in the ETH Domain in order to bridge the gap between industry and academia, to stimulate reindustrialization, and to attract leading global industrial partners in science and engineering. The activities

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of these Competence Centers have contributed to Switzerland's standing as a leading country in innovation and "value-added" developments.

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Success in a knowledge-based economy is achieved in three steps: the generation of knowledge, the transformation of knowledge into goods and services that can be profitably sold, and the creation of jobs. Switzerland, and especially the ETH Domain, is strong in several fields of natural science and technology. However, in the global knowledge-based economy, it is essential to optimize the entire production chain, starting from the generation of basic knowledge through the application of this knowledge to products and services that can compete successfully in the marketplace. The ETH Domain is well placed for this type of research and activity, and both ETH Zurich and EPFL Lausanne, as well as the research institutes, are increasing their efforts to strengthen technology transfer. Through this and via continuous improvements in its education and research programs, the ETH Domain will foster and strengthen the entrepreneurial spirit in Switzerland and provide students, the entrepreneurs of tomorrow, with the skills, technologies, and resources to launch successful new ventures.

### A LIVING LABORATORY FOR SUSTAINABLE INNOVATION

Sustainability is a central goal linking many research and teaching activities across the ETH Domain. The vision of sustainability at the ETH Domain also encompasses sustainability in campus development and operations. By launching an international initiative on campus sustainability and conducting major projects on sustainable development of its own facilities, the ETH Domain is helping to shape the global discussion on this important topic.

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#### CAMPUS SUSTAINABILITY

The ETH Domain and its institutions are committed to pushing the limits of science and technology, with the ultimate goal of enhancing the quality of life for citizens across the globe. It explores innovations with not only economic but also social and environmental benefits. Thus, sustainability is an integral part of the ETH Domain's goals. Supporting sustainable development by creating knowledge, educating leaders of tomorrow, and playing a key role in international research collaborations is the explicit goal of the ETH Domain's strategic planning 2008–2011.

While the main contribution of ETH Domain institutions to sustainable development lies in their research and teaching, the operations of the Domain's campuses need to be an integral element of the drive toward sustainability. Campus sustainability reinforces the commitment of leading universities to sustainable development by showing that they "practice what they preach." Consistency and credibility in their overall approach to sustainability is vital in the educational realm. A university campus is the students' "ecosystem" as they prepare for their future careers. Experiencing sustainability in their daily campus life could be a powerful factor in determining what leaders of tomorrow see as important or take for granted.

Sustainable campus development and maintenance is also a key opportunity for testing results from research and innovation in practice. The size of campus development projects typically lies at an interesting intermediate point between large individual structures and small towns. This enables researchers to study the

impacts of sustainability innovations that may only become apparent with a number of interacting buildings, while the overall scale on a campus is still manageable enough for controlled assessments. The ETH Domain has developed many innovations in fields such as renewable energy, energy efficiency, or mobility technologies that can be validated in a campus setting, keeping sustainable campus development in the ETH Domain at the cutting edge of technology.

In 2006, some major developments took place at the ETH Domain regarding sustainable campus issues. First, ETH Zurich expanded its planning process for the "Science City" extension and remodeling of its Hönggerberg Campus in order to involve broad representation of members of the ETH community, local residents, authorities, and representatives from politics and business. Including all stakeholders in this joint planning process is new and experimental, but has proven its worth in practice. In addition, ETH Zurich has launched an international competition to solicit ideas on sustainable planning for Science City. Winning submissions will complement the sustainable planning guidelines already established for Science City, such as the ambitious energy concept. The competition has generated broad interest from teams around the globe.

Second, Eawag moved into its new headquarters, "Forum Chriesbach." This office and lab building, which also hosts the library shared with Empa, sets new standards for sustainability.

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Through the use of innovative construction and building technologies, the building is essentially carbon neutral and does not require conventional heating and cooling systems. The result is four times less energy use than that of a typical building with commercial state-of-the-art technologies. A sophisticated sanitary system with rain water flushing and "NoMix" toilets to separate urine for improved wastewater management and for nutrient recycling in agriculture is a practical demonstration of research results from Eawag.

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In addition, "Novatlantis – Sustainability at the ETH Domain" has formed an international network for the exchange of information and experience on sustainable campus issues. The Sustainable Campus Network was started with comparative campus development case studies created in collaboration between ETH Zurich, Harvard, and Yale University, and will initiate full-fledged global networking with an international Sustainable Campus Conference in spring 2007. This network also has the potential to facilitate cross-fertilization between campus and urban sustainability programs, as Novatlantis works with Basel, Zurich, and Geneva as pilot and partner regions for an equitable and sustainable "2,000 Watt Society."

## +++++ Competence Centers

In 2006, Competence Centers were launched that link expertise across disciplines and among ETH Domain institutions and other national and international partners. These centers address emerging hot topics crucial for economic growth with social and environmental benefits, and act as gateways to facilitate collaboration between industry, society, and research.

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### COMPETENCE CENTERS

#### **Competence Center Energy and Mobility (CCEM)**

The CCEM.ch contributes to the development of a more sustainable energy system. Its research focuses on efficient provision of energy services, efficient and “zero-emission” energy conversion, and substitution of fossil energy carriers with low-carbon primary alternatives. One of its first projects is designing and testing a hydrogen-driven municipal vehicle (hy.muve). The project will cover all stages from simulation and development of power-train dynamics up through real-world operation as part of the municipal service vehicle fleet in at least two cities. This enables testing the technology in realistic operating conditions, and studying the socioeconomic aspects of niche market introduction.

#### **Competence Center Environment and Sustainability (CCES)**

The work of CCES addresses issues of sustainable land use, natural hazards and risk management, climate and environmental change, natural resource management, and food, environment and health. One example for a large-scale collaborative project is TRAMM – Triggering of Rapid Mass Movements in Steep Terrain. CCES also supports the development of technology platforms between different research projects and industry, including a network of intelligently communicating sensors as the basis of a new generation of tools for environmental monitoring. Joint education and outreach activities will increase the visibility of the Center and the integration of natural risks activities will be pursued through the implementation of a Public-Private Partnership.

### **Competence Center for Materials Science and Technology (CCMX)**

CCMX is based on the recognition that while materials development draws on basic science and fundamental research, transfer to application requires close collaboration between academic laboratories and industry. The activities of CCMX are currently focused on four areas: surface, coatings, and particles engineering; materials for the life sciences; nano- and microscale materials characterization; and materials for micro- and nanosystems. As an example of a collaborative initiative, in the latter area research projects address topics at the intersection of electronics, electrical engineering, and materials science, and involve collaboration with industrial and academic experts on computer science, biology, and medicine.

### **Swiss Initiative in Systems Biology (SystemsX)**

With a goal to make Switzerland a global leader in systems biology, SystemsX brings together researchers from biology, chemistry, physics, mathematics, informatics, engineering, and medicine to understand and explain the workings of entire biological systems. One of its early projects models the network of interactions between pathogenic bacteria and various cell types of the host organism in order to develop new ways of preventing or treating infectious diseases and uncontrolled inflammatory responses. In SystemsX, academic partners from the ETH Domain and the uni-

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versities of Zurich and Basel collaborate with partners from the pharmaceutical industry, particularly Novartis and Roche.

### **National Competence Center Biomedical Imaging (NCCBI)**

Biomedical imaging is the process of obtaining information from biological samples with spatial localization, ranging from molecular complexes to cells and tissue cultures, using samples from insects and mice to humans. The NCCBI supports multidisciplinary and multi-institutional activities, particularly high-risk, high-yield scientific projects that are difficult to support through established funding mechanisms. Of particular interest are efforts that lead to paradigm shifts or new technologies in biomedical imaging, and that allow biomedical researchers to convert previously untestable hypotheses of biological importance into testable ones.



+++ WSL Birmensdorf, Ozone Effects on Trees



Organizational Chart 2007

<b>Federal Department of Home Affairs</b>		
<b>Board of the Swiss Federal Institutes of Technology</b>		
Prof. Dr. Alexander J. B. Zehnder, President Prof. Dr. Ernst Buschor, Vice-President		
<b>Group of Research Institutions</b>		
<b>ETH Zurich</b>	<b>PSI</b>	<b>Empa</b>
Prof. Dr. Ralph Eichler President from 1 September 2007 Prof. Dr. Konrad Osterwalder President ad interim until 31 August 2007	Martin Jermann, Dipl. Phys. Director ad interim from 1 September 2007 Prof. Dr. Ralph Eichler Director until 31 August 2007	Prof. Dr. Louis Schlapbach Director
<b>EPF Lausanne</b>	<b>WSL</b>	<b>Eawag</b>
Prof. Dr. Patrick Aebischer President	Prof. Dr. James Kirchner Director from 1 August 2007 Dr. Jakob Roost Director ad interim until 31 July 2007	Prof. Dr. Janet Hering Director

PEOPLE

The ETH Board 2007



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| <ol style="list-style-type: none"> <li>1 Prof. Dr. Alexander J. B. Zehnder, President</li> <li>2 Prof. Dr. Ernst Buschor, Vice-President</li> <li>3 Prof. Dr. med. Patrick Aebischer, President of EPF Lausanne</li> <li>4 Prof. Dr. med. Adriano Aguzzi, Faculty of Medicine of the University of Zurich</li> <li>5 Dr. Monica Duca Widmer, Managing Director EcoRisana SA, Manno TI, Member of Great Council of the Canton of Ticino</li> <li>6 Prof. Dr. Ralph Eichler, Director of the Paul Scherrer Institute (PSI) until 31 August 2007, President of ETH Zurich from 1 September 2007</li> <li>7 Prof. Dr. Janet Hering, Director of Eawag, Representative of the research institutions of</li> </ol> | <ol style="list-style-type: none"> <li>the ETH Domain from 1 September 2007</li> <li>8 Prof. Dr. Paul Herrling, Head of Corporate Research, Novartis International AG</li> <li>9 dipl. Ing. ETH Beth Krasna, Consultant, Chêne-Bougeries</li> <li>10 lic. oec. Thierry Lombard, Senior Partner, Lombard Odier Darier Hentsch &amp; Cie</li> <li>11 Prof. Dr. Konrad Osterwalder, President ad interim and Rector of ETH Zurich until 31 August 2007</li> <li>12 Dr. Markus Stauffacher, Representative of the University Assemblies of ETH Zurich and EPF Lausanne</li> </ol> |
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The ETH Board is responsible for strategic management of the ETH Domain. The Swiss Federal Council elects the following members to the ETH Board: President, Vice-President, the Director of one of the four research institutes, one member nominated by the university assemblies, and five other members. The Presidents of ETH Zurich and EPFL Lausanne are ex officio members of the ETH Board.

### New Members of the ETH Board

- On 27 April 2006, the Swiss Federal Council elected Geneva banker and economist Thierry Lombard as a new member of the ETH Board. Lombard has worked for a number of banks in Switzerland, Canada, and the U.S., and has been Senior Partner at the private bank Lombard Odier Darier Hentsch & Co since 1995.
- On 28 November 2006, the university assemblies of ETH Zurich and EPF Lausanne nominated Dr. Markus Stauffacher to the ETH Board. Stauffacher is lecturer at the Institute of Animal Sciences. He represents the faculty, assistants, scientific coworkers, students, and administrative and technical staff of the two universities. He replaces Dr. Kristin Becker van Slooten.

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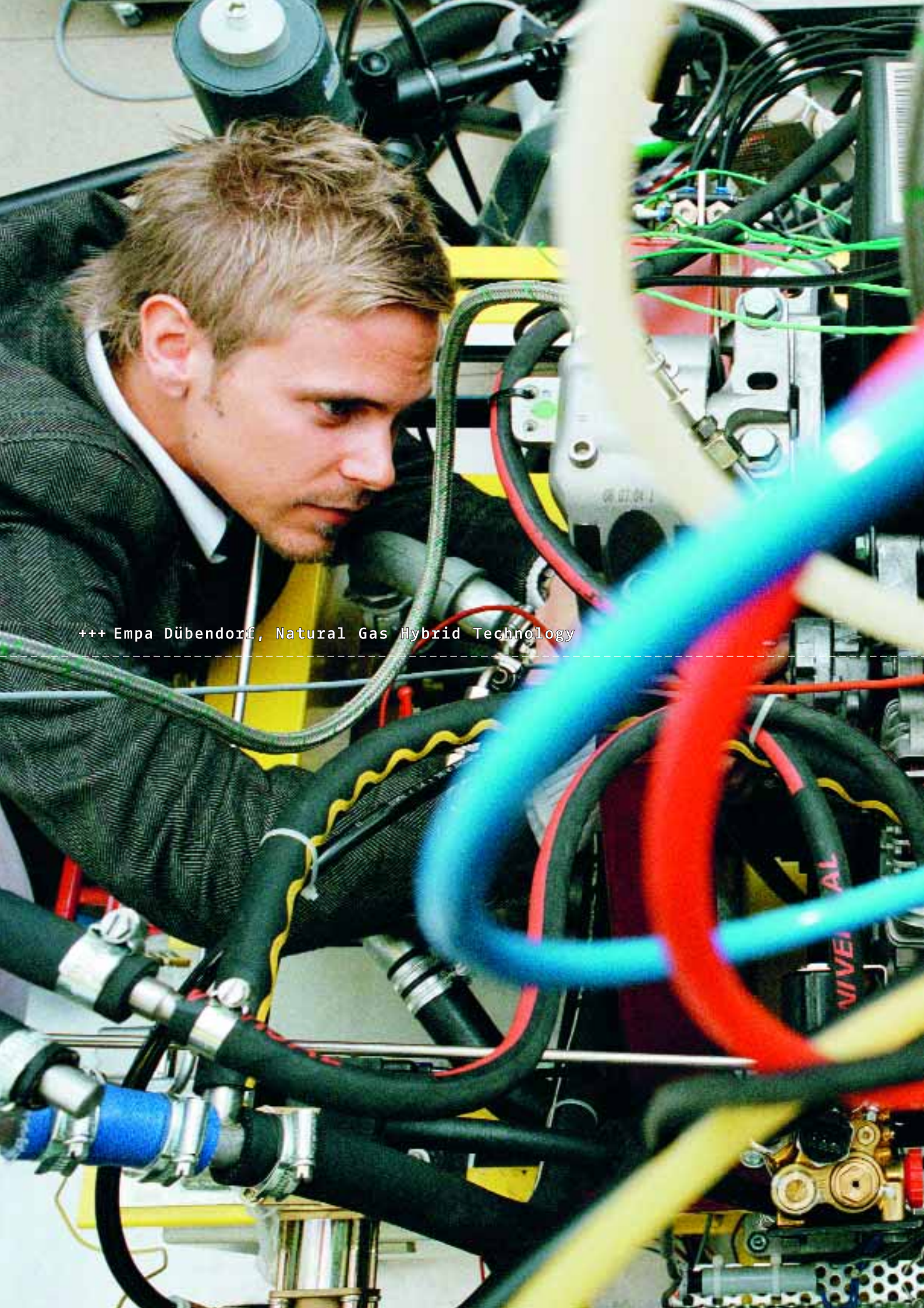
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### New Interim President of ETH Zurich

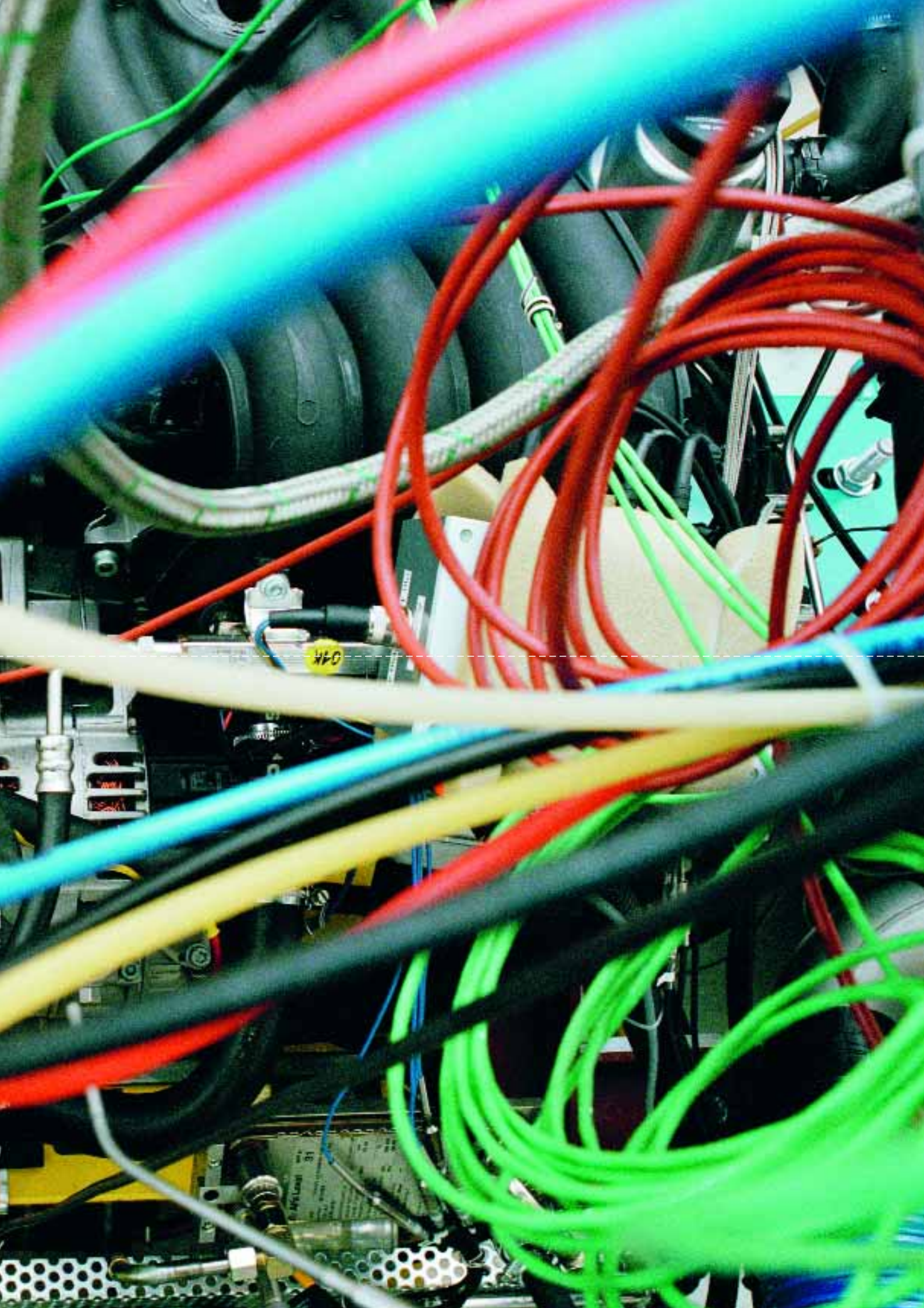
Prof. Dr. Konrad Osterwalder, rector of ETH Zurich, has been the interim president of ETHZ since 2 November 2006, after the resignation of Prof. Dr. Ernst Hafén. Osterwalder has been full professor for mathematics at ETHZ since 1977, and was elected Rector of ETHZ in 1995. The search for a new president is under way with the goal of identifying a world-class leader in the near future.

### New Director of Eawag

On 28 June 2006, the Swiss Federal Council elected Prof. Dr. Janet Hering as the director of Eawag. Hering received her education at Cornell, Harvard, and MIT. She got to know Eawag well when working there as a postdoctoral researcher. Her most recent position was full professor for environmental science and technology at the California Institute of Technology, and executive officer of the Keck Laboratories for Bioengineering, Environmental Science & Engineering, and Materials Sciences. She assumed her new position as director of Eawag on 1 January 2007.



+++ Empa Dübendorf, Natural Gas Hybrid Technology



## +++++ Indicators

### Indicators for the ETH Domain

	2001	2006	Change in % since 2001
<b>Students*</b>	<b>13,425</b>	<b>14,960</b>	<b>11.0</b>
Bachelor students		9,571	
Master students		2,734	
Diploma students	13,425	2,655	
Doctoral students	3,083	4,201	36.0
Postgraduate students	599	587	-2.0
<b>Total number of students</b>	<b>17,107</b>	<b>19,748</b>	<b>15.0</b>
<b>Degrees</b>			
Bachelor		1,041	
Master		876	
Diplomas	1,899	951	
Doctorates	687	861	25.0
Postgraduates	351	332	-26.0
<b>Total number of degrees</b>	<b>2,937</b>	<b>3,990</b>	<b>36.0</b>
<b>Staff</b>			
Professors**	505	584	16.0
Scientific staff***	6,596	7,144	8.0
Administrative and technical staff****	3,687	4,544	23.0
<b>Total staff*****</b>	<b>10,788</b>	<b>12,272</b>	<b>25.0</b>
<b>Financial resources (CHF million)</b>			
Federal financial contribution	1,728.2	1,880.3	9.0
Second-/third-party funds and other revenues	389.1	536.7	38.0
<b>Total revenues</b>	<b>2 117.4</b>	<b>2,417.1</b>	<b>14.0</b>

\* Bologna reform: Diploma students in 2001 are compared to the total number of bachelor, master, and diploma students in 2006

\*\* Swiss Universities Information System – categories I and II

\*\*\* Swiss Universities Information System – categories III–X

\*\*\*\* Swiss Universities Information System – categories XI–XVII

\*\*\*\*\* Equivalent number of full-time posts

## Indicators for the ETH and the Research Institutions 2006

	ETH Board	ETHZ	EPFL	PSI	WSL	Empa	Eawag	Total
<b>Degrees</b>								
Bachelor		381	660					1,041
Master		271	605					876
Diplomas		951						951
Doctorates		569	292					861
Postgraduate diplomas		226	106					332
Supervised doctorates				275	109	162	107	653
<b>Research</b>								
Publications ISI 2003*		8,246	4,027	1,936	262	262	538	15,271
Publications non ISI 2003**				200	49	319	58	626
Patents applied for		84	36	42	1	20		183
License and technology transfer contracts		28	56	39	23	10		156
Spin-offs and start-ups		16	8	1		2	1	28
<b>Staff</b>								
<b>Professors***</b>								
Men		286.0	167.2					453.2
Women		23.0	7.3					30.3
<b>Assistant professors***</b>								
Men		44.0	38.0					82.0
Women		6.0	12.5					18.5
<b>Scientific staff***</b>								
Men		2,875	1,523					4,398
Women		947	432					1,379
<b>Administrative and technical staff***</b>								
Men		1,267	580					1,847
Women		849	430					1,279
Trainees		166	77					243
Newly elected professors		43	28	78	13	36	27	225
<b>Financial resources (CHF million)</b>								
Federal financial contribution	12.3	983.6	455.9	238.4	47.7	92.7	49.8	1,880.4
Second- and third-party funds	0.0	196.0	117.2	43.8	18.8	27.1	13.5	416.4
Other revenues (incl. financial and securities income)	0.0	56.9	36.4	10.6	1.8	13.8	1.0	120.4

\* Institute for Scientific Information, Thomson ISI (source CEST)

\*\* Non-Thomson ISI

\*\*\* Equivalent number of full-time positions

### ETH Zurich – Students in Bachelor, Master, and Diploma Courses per Department 2006

Disciplines	Women	Men	Non-Swiss	Total
Civil Engineering and Geomatics	715	1,337	283	2,052
Engineering Sciences	296	2,881	540	3,177
Natural Sciences and Mathematics	1,238	1,899	491	3,137
System-oriented Sciences	713	801	122	1,514
Management studies, social sciences and other	90	253	37	343
<b>ETHZ total</b>	<b>3,052</b>	<b>7,171</b>	<b>1,473</b>	<b>10,223</b>

### EPF Lausanne – Number of Doctoral Students by Discipline 2006

Disciplines	Women	Men	Non-Swiss	Total
Civil Engineering and Geomatics	88	188	182	276
Engineering Sciences	132	733	492	865
Natural Sciences and Mathematics	317	731	577	1,048
System-oriented Sciences	220	279	245	499
Management studies, social sciences and other	29	77	66	106
<b>ETHZ total</b>	<b>786</b>	<b>2,008</b>	<b>1,562</b>	<b>2,794</b>

INDICATORS

### EPF Lausanne – Students in Bachelor and Master Courses per Department 2006

Disciplines	Women	Men	Non-Swiss	Total
Basic Sciences (SB)	248	666	198	914
Life Sciences (SV)	141	189	55	330
Engineering Sciences and Techniques (STI)	155	1,097	340	1,252
Computer and Communication Sciences (IC)	111	743	316	854
Architecture, Civil and Environmental Engineering (ENAC)	497	867	290	1,364
Management of Technology (MTE)	7	16	11	23
<b>EPFL total</b>	<b>1,159</b>	<b>3,578</b>	<b>1,210</b>	<b>4,737</b>

### EPF Lausanne – Number of Doctoral Students by Discipline 2006

Disciplines	Women	Men	Non-Swiss	Total
Basic Sciences (SB)	94	279	244	373
Life Sciences (SV)	59	79	100	138
Engineering Sciences and Techniques (STI)	93	360	268	453
Computer and Communication Sciences (IC)	33	171	132	204
Architecture, Civil and Environmental Engineering (ENAC)	60	147	117	207
Management of Technology (MTE)	13	19	26	32
<b>EPFL total</b>	<b>352</b>	<b>1,055</b>	<b>887</b>	<b>1,407</b>



+++ Eawag Dübendorf, Arsenic Biosensor



## FINANCIAL OVERVIEW

The federal contributions planned for the 2004–2007 payment framework were unfortunately reduced once again, decreasing the annual growth planned for the ETH Domain from 4% to 2%. However, the Domain has experienced a steady and encouraging increase in second- and third-party funds.

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### RESOURCES

The Federal Council approved a payment framework of CHF 7,830 million for the ETH Domain for the 2004–2007 period – an amount which would have resulted in a 4% average annual growth. This relatively high rate of growth was envisaged because of the key importance of education and research for Switzerland, and was intended to provide planning predictability for the ETH Domain. However, actual annual budgets must be approved by the Swiss Parliament, and the current difficulties in the federal financial realm led to a reduction in the amount of funds received, decreasing the intended growth from 4% to 2%. Concentrated effort was applied to avoid significant shortfalls in attaining the goals of the 2004–2007 performance mandate despite the significant decrease in funding.

In contrast, revenues from third parties (second-/third-party funds and other revenues) increased significantly, rising by CHF 44.3 million to CHF 536.8 million. However, these revenue increases could not fully compensate for the CHF 78 million cut in federal contributions.

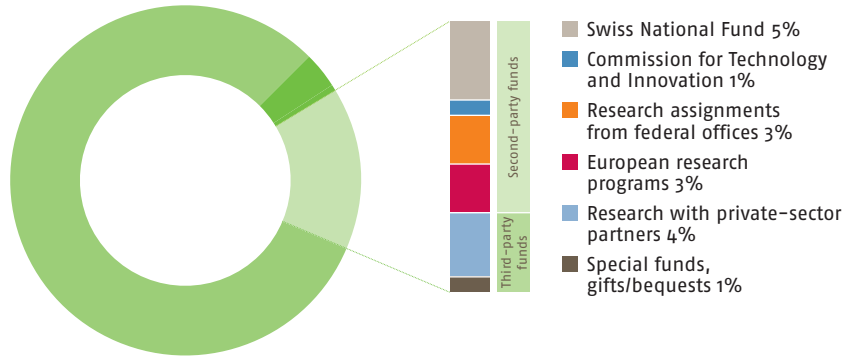
The ETH Domain's total revenues (including financial and securities income) for 2006 were CHF 2,417.2 million. The Swiss Confederation

supplied roughly 90% of funding (the federal financial contribution plus second-party funds from government-affiliated organizations). The private sector provided 5% of revenues via research collaborations, while the remaining 5% were from diverse sources (sales, fees, services, tuitions, financial income, etc.).

Personnel costs were the largest expenditure, accounting for 63% of total spending. Capital expenditures utilized 15% of funds, with building investments representing a growing proportion of this. Further current expenditures accounted for the remaining 22% of the total.

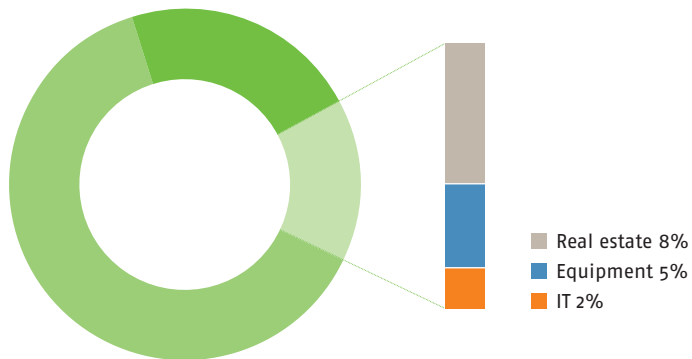
### ETH Domain: 2006 Financing

- Federal financial contribution 78%
- Other revenues 5%
- Second- and third-party funds 17%



### ETH Domain: Use of Funds, 2006

- Current expenditures 85%
- Staff expense 63%
- Other current expenditures 22%
- Capital expenditures 15%



## Balance Sheet

The ETH Domain's consolidated balance sheet is structured pursuant to the minimum requirements in accordance with commercial principles. The total of CHF 1,491.7 million includes all assets owned by the ETH Domain. Not included is real estate owned by the Swiss Confederation, which has a book value of CHF 4.8 billion. The total assets used by the ETH Domain are approximately CHF 6.5 to 7.0 billion.

On the asset side, liquid funds had to be increased in order to avoid liquidity shortages, as the ETH Domain manages its payment transactions autonomously as of 2007. This increase, partly compensated by a decrease in accounts receivable as well as in second- and third-party funds, raised current assets by CHF 110.5 million overall. Funds include the asset item of reserves that originate from the federal financial contribution. Fixed assets include mainly the residual value of mobile investment assets acquired since 2000.

Assets from second- and third-party funds include remuneration from the effective influx

On the other side of the balance sheet, current liabilities could be reduced slightly. However, additional provisions had to be made in long-term liabilities. In particular, these include holiday and overtime claims of employees along with risk management provisions. In contrast to provisions, with regard to the internal performance commitments of CHF 95.6 million, only the financially relevant portion was capitalized under own funds (a complete view is given in the Notes). Internal performance commitments arise mainly from appointment procedures for new professorships, and for teaching and research projects.

Equity increased by CHF 54.9 million to CHF 525.4 million. This figure includes mainly the residual value of mobile investment assets. The process of building up equity via capitalization of residual values of equipment and IT goods will soon be completed. Annual depreciation will level off to CHF 130 million and subsequently will virtually correspond to annual capital expenditure for equipment and IT. In addition to reserves from the financial contribution, equity includes free reserves of the two Federal Institutes

## RESOURCES

of funds. The portion not used at year-end is reported as a corresponding performance obligation in tied capital on the liabilities side. The respective inventory change is entered as affecting net income. The total of tied capital does not, however, allow a reliable conclusion regarding the overall volume of research projects. But the total of project placing is higher than the capitalized assets of CHF 621.3 million.

of Technology and the research institutes. These encompass, among others, management reserves, originating partly from retaining a portion of the interest yield of financial assets (from second- and third-party funds) or from centrally collected overhead surcharges. All reserves are set aside to finance future construction and research projects, or to cover losses.

## ETH Domain: Tied Fund Capital

in CHF m	2005	in %	2006	in %
Research promotion	76.1	12	93.3	13
Research mandates from federal offices	56.7	9	66.9	9
European research programs	32.2	5	41.2	6
Second-party funds	165.0	26	201.5	28
Research in conjunction with business partners	226.1	35	251.9	35
Special funds, endowments/bequests	111.8	17	123.4	17
Cantons, municipalities	47.8	7	44.6	6
Third-party funds	385.6	60	419.8	59
Performance commitments (own resources)	94.0	15	95.6	13
<b>Total</b>	<b>644.6</b>	<b>100</b>	<b>716.9</b>	<b>100</b>

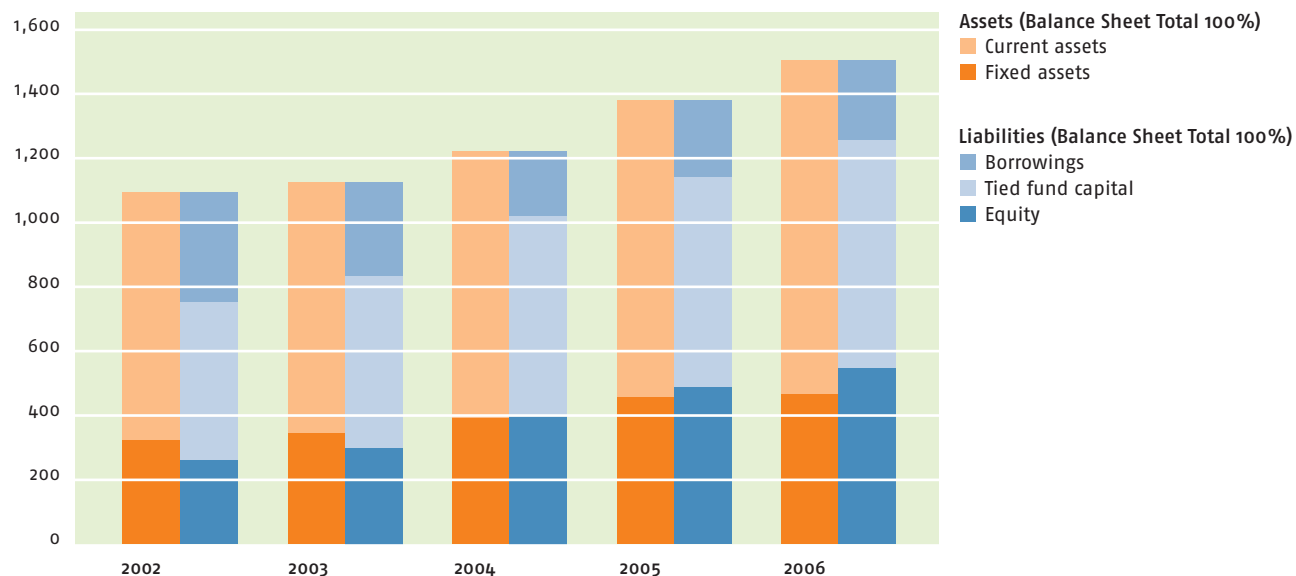
## ETH Domain: Consolidated Balance Sheet

in CHF m	2005	in %	2006	in %	Diff. abs.	Diff. in %
<b>Assets</b>	<b>1,355.0</b>	<b>100.0</b>	<b>1,491.7</b>	<b>100.0</b>	<b>136.7</b>	<b>10.1</b>
Current assets	928.2	68.5	1,038.6	69.6	110.5	11.9
Cash and securities	14.3		84.7		70.5	
Accounts receivable	265.5		235.0		-30.5	
Funds	63.5		72.3		8.8	
Second- and third-party funds	552.4		611.5		59.2	
Inventories	13.4		12.4		-1.0	
Accruals	19.2		22.7		3.6	
Fixed assets	426.8	31.5	453.1	30.4	26.3	6.2
Property, plant and equipment	404.8		432.8		28.1	
Financial assets	22.0		20.3		-1.8	
Intangible assets	0.0		0.0		0.0	
<b>Liabilities and equity</b>	<b>1,355.0</b>	<b>100.0</b>	<b>1,491.7</b>	<b>100.0</b>	<b>136.7</b>	<b>10.1</b>
Liabilities	239.9	17.7	249.5	16.7	9.6	4.0
Current liabilities	164.2	12.1	146.6	9.8	-17.7	-10.7
Current financial payables	124.4		100.3		-24.2	
Other payables	11.5		10.7		-0.8	
Deferrals	28.3		35.7		7.3	
Long-term liabilities	75.6	5.6	102.9	6.9	27.3	38.2
Financial payables	7.0		15.0		8.0	
Other payables	0.0		0.0		0.0	
Provisions	68.6		87.8		19.2	
Tied capital	644.6	47.6	716.9	48.1	72.2	11.2
Second- and third-party funds	550.7	40.6	621.3	41.7	70.6	12.8
Own funds (performance commitments)	94.0	6.9	95.6	6.4	1.6	1.7
Equity	470.5	34.7	525.4	35.2	54.9	11.7
Reserves from federal financial contributions	34.3	2.5	47.5	3.2	13.2	38.6
Free reserves	43.4	3.2	58.5	3.9	15.1	34.7
Capital and other reserves	392.7	29.0	419.3	28.1	26.6	6.8

52

53

CHF million



## Income Statement

Compared to 2005, revenues and expenses have increased almost identically. This is an indication of the growing number of teaching and research projects in 2006 financed, in particular, with second-party funds. No substantial changes occurred in financing of the ETH Domain compared to the past year. Approximately 90% of revenues of the ETH Domain originated from the Swiss Confederation and from public authorities, 5% from research collaborations with the private sector, and another 5% from diverse sources (services, sales, fees including tuitions, financial income, capital gains, etc.). Compared to the 2005 account, second-party funds – research assignments from federal offices and affiliated organizations – rose strongly, with an increase of 17%.

In absolute numbers, total revenues in 2006 of CHF 2,417.2 million (including financial and securities income) stood vis-à-vis total expenses of CHF 2,179.8 million (including extraordinary expenses). This resulted in net earnings of CHF 237.4 million.

and so forth. The portion of salaries financed via second- and third-party funds stayed constant at slightly over CHF 300 million. This corresponds to approximately 3,000 full-time equivalents.

Another 28% of total expenses was allotted to the further shares of ordinary expenses. In comparison to the previous year, there were no substantial changes in the respective proportions in 2006. The decrease in services is related to the fact that fewer expert opinions, reports, and similar services were provided to external parties. Occupancy expenses include only additional property that was rented. Rents for the whole real-estate portfolio used by the ETH Domain would amount to approximately CHF 450 million, according to surveys. The general price increase for energy led to a cost surge in infrastructure expenses.

The remaining 2% fell to extraordinary expenses: dues (membership dues for national and international organizations, scholarships, etc.) and changes in provisions in connection with increasing risks.

The counterpart to this account, which is based on input (expenses and capital expendi-

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## RESOURCES

The net earnings should not be regarded as a profit however, since the federal financial contribution also includes portions for construction expenditures that are absent in the financial accounting of the ETH Domain. The overall values management of real estate of the ETH Domain is carried out by the Swiss Federal Office for Building and Logistics for the Confederation. For this reason, the annual earnings in the income statement of the ETH Domain register as too positive by at least the depreciation of real estate, to the annual amount of CHF 130–140 million. In addition, construction expenditures are subject to large fluctuations – the higher the portion for construction expenditures in the financial contribution, the higher net earnings.

The bulk of the ETH Domain's expenses, a total of CHF 1,504.2 million or 69% of all expenses, was applied to payroll. With this, personnel expenses corresponded to the average of the previous years. The increase of CHF 53.3 million compared to the 2005 account was a result, on the one hand, of an increase in full-time jobs by approximately 300, and was applied, on the other hand, to compensation measures such as inflationary adjustment, structural alignments,

tures), is the performance accounting, which quantifies the output (cost and performance accounting). For this, the performance rendered needs to be differentiated into the three key areas of the academic environment – teaching, research, and services – in correspondence with the goals of the performance mandate 2004 to 2007 of the Federal Council for the ETH Domain. In order to take quality into account in the assessment of target achievement, the outcome has to be recorded as well. These are all typical aspects of a cost and performance accounting. However, the cost accounting of the two Federal Institutes of Technology and the research institutes did not yet include the desired information as of the end of 2006.

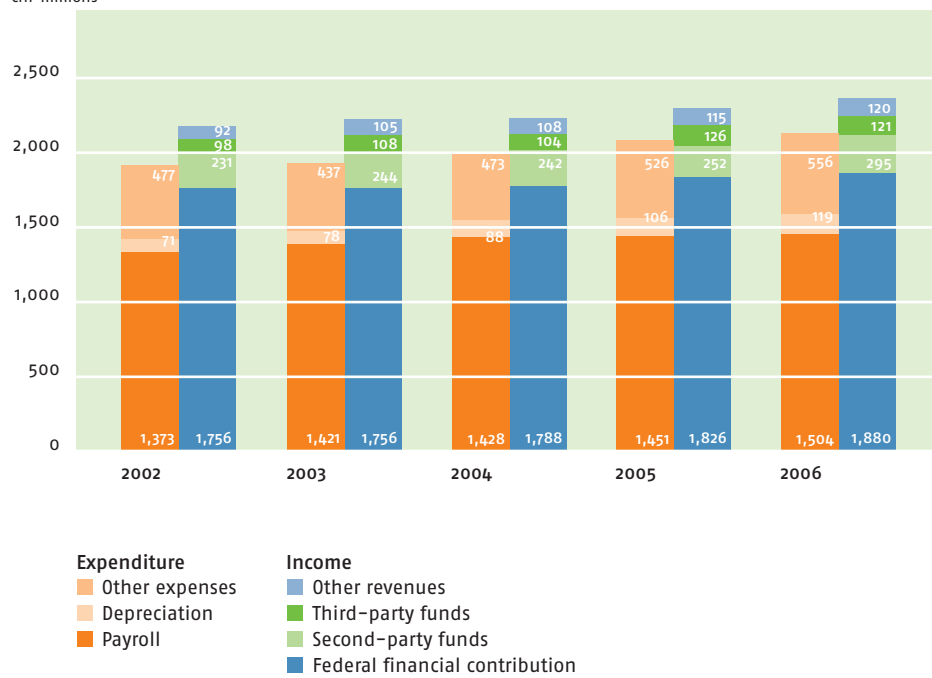
## ETH Domain: Consolidated Income Statement

in CHF m	2005	in %	2006	in %	Diff. in CHF	Diff. in %
<b>Revenues</b>	<b>2,307.3</b>	<b>100.0</b>	<b>2,404.8</b>	<b>100.0</b>	<b>97.5</b>	<b>4.1</b>
Federal financial contribution	1,826.3	79.2	1,880.4	78.2	54.1	3.0
Second- and third-party revenues	481.1	20.8	524.4	21.8	43.4	9.0
Compensation from second-party funds	251.6	10.9	295.3	12.3	43.8	17.4
Compensation from third-party funds	125.9	5.5	121.1	5.0	-4.8	-3.8
Proceeds of sales and service revenues						
(including IT revenues)	51.3	2.2	49.3	2.1	-2.0	-3.9
Fees (including tuition)	25.9	1.1	29.8	1.2	3.8	14.8
Revenues from reimbursements	3.8	0.2	4.3	0.2	0.5	12.5
Other revenues	22.6	1.0	24.6	1.0	2.1	9.2
<b>Expenses</b>	<b>2,025.1</b>	<b>88.9</b>	<b>2,135.9</b>	<b>88.8</b>	<b>83.8</b>	<b>3.9</b>
Material expenses	93.1	4.0	102.6	4.3	9.5	10.2
Material expenses	71.5		71.2		-0.3	
Merchandise	0.0		0.0		0.0	
Equipment, machinery, vehicles	21.6		31.4		9.8	
Personnel expenses	1,450.9	62.9	1,504.2	62.5	53.3	3.7
Wages and salaries	1,210.0	100.0	1,252.6	100.0	42.6	3.5
Social insurance	71.8	5.9	73.3	5.9	1.6	2.2
Personal insurance	96.0	7.9	101.9	8.1	5.9	6.1
Accident and health insurance	6.2	0.5	6.8	0.5	0.5	8.4
Other personnel expenses	66.8	5.5	69.5	5.6	2.7	4.0
Other operating expenses	191.7	8.3	188.1	7.8	-3.6	-1.9
IT and telecommunications	70.3		70.0		-0.4	
Other services, fees	86.3		82.8		-3.5	
Other operating expenses	35.2		34.7		-0.4	
Bad debt expense	-0.1		0.5		0.7	
Infrastructure expense	141.3	6.1	153.8	6.4	12.4	8.8
Occupancy, repair, leases	28.7		27.0		-1.6	
Maintenance, repair, leases	53.6		64.3		10.7	
Water, power, consumables	41.9		45.8		3.9	
Administrative expense	17.1		16.6		-0.5	
Depreciation	106.4	4.6	119.3	5.0	12.9	12.2
Changes in second- and third-party funds	18.7	0.8	72.8	3.0	54.1	289.5
Changes in performance commitments	49.9	2.2	-4.9	-0.2	-54.8	-109.8
<b>Income 1</b>	<b>255.3</b>	<b>11.1</b>	<b>268.9</b>	<b>11.2</b>	<b>13.6</b>	<b>5.3</b>
<b>Extraordinary expenses/revenues</b>	<b>30.8</b>	<b>1.3</b>	<b>43.9</b>	<b>1.8</b>	<b>13.1</b>	<b>42.7</b>
Extraordinary income	2.3		1.0		-1.3	
Contributions/transfer expenses	20.9		20.9		0.0	
Nonoperating income	-1.2		-1.3		-0.1	
Changes in provisions	8.7		23.3		14.5	
<b>Income 2</b>	<b>224.5</b>	<b>9.7</b>	<b>225.0</b>	<b>9.4</b>	<b>0.5</b>	<b>0.2</b>
Financial income	9.1		11.2		2.1	
Capital gains	2.3		1.2		-1.1	
<b>Net earnings*</b>	<b>235.9</b>	<b>10.2</b>	<b>237.4</b>	<b>9.9</b>	<b>1.4</b>	<b>0.6</b>

\* Before investments (real estate, movables, IT)

## ETH Domain: Consolidated Income Statement

CHF millions



RESOURCES

### The Federal Financing Contribution

The ETH Domain had available a financing contribution from the Swiss Confederation of CHF 1,880.4 million in 2006. Compared to the 2005 accounts, the increase was CHF 54.1 million or a nominal 3%. However, taking inflation into account, an actual growth of just 1.9% remained. This meant that CHF 34 million was actually available in 2006 for additional tasks related to the performance mandate. According to the government's education, research, and technology statement 2004–2007, CHF 2,005 million was originally planned for 2006. Taking into account the budget-neutral corrections in the 2006 financing plan, real reductions of approximately CHF 78 million resulted, from the federal relief programs (EP03, EP04) or from budget adjustments (realization departmental ceiling requirements).

In the financial account of the Confederation, the total available financing contribution was utilized. From a commercial point of view, also in 2006 the option of building up reserves was put to use; the stock of reserves on the asset side increased by CHF 13.2 million. Part of these reserves is reported on the liabilities side under internal performance commitments, or was fully deferred.

### ETH Domain: Federal Financial Contribution

in CHF m	2005	in %	2006	in %
<b>ETH Board</b>	10.7	0.6	12.0	0.6
ETH Board, change in reserves	7.9	0.4	0.3	0.0
<b>ETH Zurich</b>	959.2	52.5	983.6	52.3
<b>EPF Lausanne</b>	440.5	24.1	455.9	24.2
<b>PSI</b>	224.3	12.3	238.4	12.7
<b>WSL</b>	45.4	2.5	45.1	2.4
WSL, change in reserves	1.1	0.1	2.6	0.1
<b>Empa</b>	95.6	5.2	85.5	4.5
Empa, change in reserves	-5.0	-0.3	7.3	0.4
<b>Eawag</b>	55.0	3.0	46.7	2.5
Eawag, change in reserves	-8.4	-0.5	3.1	0.2
<b>Total</b>	<b>1,826.3</b>	<b>100.0</b>	<b>1,880.4</b>	<b>100.0</b>
ETH Domain, change in reserves	-4.3	-0.2	13.2	0.7

### Criteria-Based Funding Allocation

For the first time, a portion of the federal financing contribution (10% of the budgets of the two Federal Institutes of Technology and the research institutes) was allocated based on criteria, as required by the performance mandate. In a so-called simplified model, the following weighted indicators were applied in two closed systems (one for the two Federal Institutes of Technology, and one for the four research institutes).

#### Federal Institutes of Technology

Indicator	Weight
1. Students	20.0%
2. Graduates	27.5%
3. Postgraduate degrees	2.5%
4. Doctorates	12.5%
5. Second-/Third-party expenses	15.0%
6. Publications	7.5%
7. Patents	2.5%
8. Spin-offs	2.5%
9. Ranking	10.0%
<b>Total</b>	<b>100.0%</b>

### Second- and Third-Party Funds/Revenue from Third Parties

Total revenue from third parties (second- and third-party funds and other revenue including financial and securities income) increased again significantly in 2006, by CHF 44.3 million to a total of CHF 536.8 million. This represents a share of approximately 22% of total revenue in the 2006 account. This proportion corresponds approximately to the average for other Swiss universities (around 20% for 2005, according to the Swiss Federal Statistical Office SFSO).

Compensation from second-party funds was CHF 295.3 million – higher than both the expectation and the previous year's value (2005: CHF 251.6 million). The volume of second-party funds is subject to the same economic cycles as the federal financing contribution – that is, a difficult financial situation for the Confederation can impact the available volume. A slight decrease to CHF 91.7 million was recorded for actual third-party funds from collaborations with private-sector partners. However, this amount is in the bracket of the long-time average of approximately CHF 100 million. The other revenue items,

## RESOURCES

#### Research Institutes

Indicator	Weight
1. Number of supervised dissertations	25.0%
2. Professors	15.0%
3. Teaching volume	15.0%
4. Bibliometrics	25.0%
5. Second-/Third-party funds	20.0%
<b>Total</b>	<b>100.0%</b>

The application of the indicators led to a budget-neutral reallocation of the budgets, on the one hand favoring EPF Lausanne (at CHF +3.0 million), on the other hand the WSL (at CHF +0.15 million) and the Eawag (at CHF +0.7 million). In contrast, the share of the federal financing contribution allocated to ETH Zurich, the PSI, and the Empa decreased.

The simplified model will be applied an additional time in 2007. From 2008 onward, it will be replaced by a new, more outcome-oriented instead of output-oriented model.

which contributed approximately CHF 120 million additionally, have not changed significantly compared to the 2005 account.

As a result of the different focuses of the two Federal Institutes of Technology and the research institutes, the share in revenues from third parties varies significantly. Funds from research subsidies go mainly to the two Federal Institutes of Technology and the PSI. As in the previous year, EPF Lausanne again received a high proportion of funds from EU Research Framework Programmes. ETH Zurich has a high proportion of third-party funds from the private sector and from special funds. Also, the funding proportion based on research assignments from federal offices is comparatively higher at ETH Zurich than at EPF Lausanne. Large differences in the structure of revenues from third parties can also be found between the research institutes. At PSI, considerable amounts originate from the use of the Swiss Light Source (SLS). WSL receives departmental research funds for the Swiss National Forest Inventory and for projects in avalanche hazard alerts and the Swiss habitat protection. A high portion of the revenues at Empa is from mandatory testing regulations, tests of materials,

and so forth. Revenue from mandatory sources include tuitions at the two Federal Institutes of Technology (2006: CHF 21.6 million), which are directly related to the development of the number of students.

The ETH Domain puts significant effort into attracting additional second- and third-party funds. In some cases, solutions based on so-called public-private partnerships are considered. However, it may not be omitted from consideration that second- and third-party funds that are, for example, used to purchase equipment, also generate consequential costs for additional required infrastructure. The issue of a proportionate compensation for the infrastructure is increasingly broached at the Federal Institutes of Technology and the research institutions, and is considered for the future.

The chart "Development of second-/third-party funds" shows a slightly distorted picture, as funds for projects under EU research programs before 2000 were handled under the aegis of the State Secretariat for Education and Research, and were included in the category "research assignments from federal agencies."

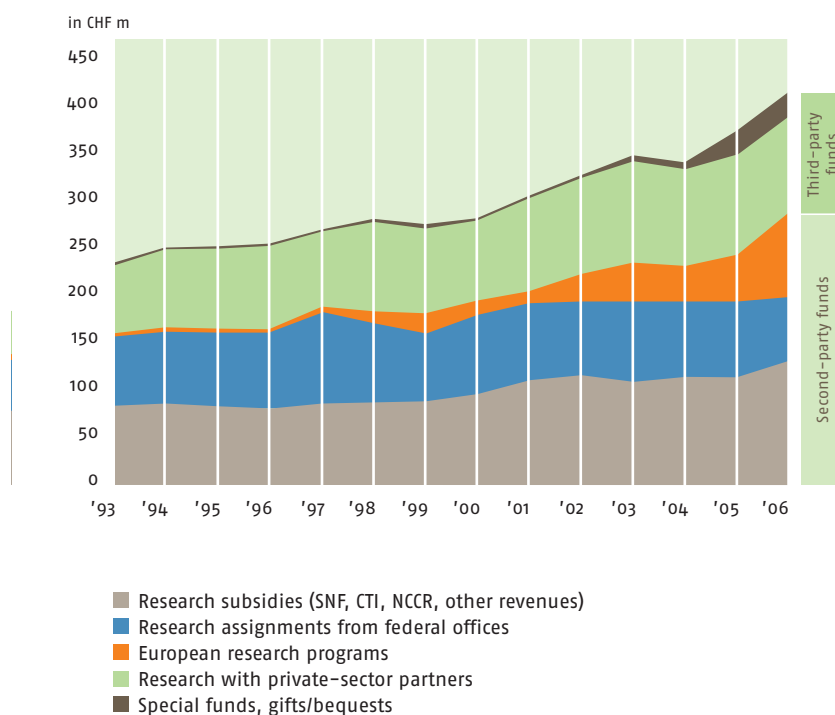
A continued increase in the proportion of revenues from third parties compared to total revenues can be observed. The financing relationship of nine parts public authorities (Swiss Confederation and its affiliated organizations [first- and second-party funds] and EU monies) to one part private-sector has not changed. The reported increase of third-party funds and other revenues from third parties between 1999 and 2000 is due to bookkeeping by the ETH Domain as a separate entity in 2000. From this point in time onward, revenues in the amount of CHF 40 to 45 million, which had been disclosed in the Confederation's state budget until 1999, now flowed into the ETH Domain's own accounts according to the gross coverage principle.

In particular, the proportion of second-party funds (2006: CHF 295.3 million) within revenues from third parties has increased continuously, and at year-end 2006 was 12% of total revenues (CHF 2,412.2 million). This percentage, however, is not only impacted by real growth of revenues from third parties, but also a result of the stagnation of the federal financial contribution.

### ETH Domain: Sources of Second- and Third-Party Funds

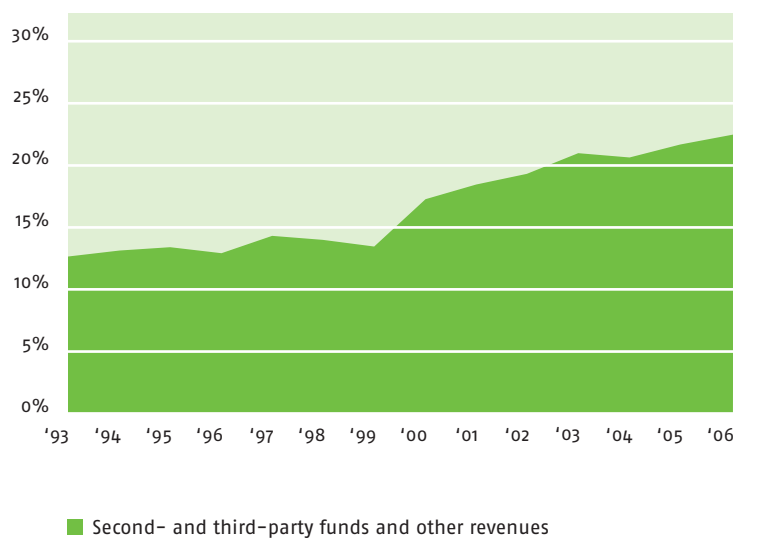
in CHF m	2005	in %	2006	in %
<b>Total second-party funds</b>	<b>251.6</b>	<b>67</b>	<b>295.3</b>	<b>71</b>
<b>Research subsidies, of which:</b>	<b>125.5</b>	<b>33</b>	<b>143.8</b>	<b>35</b>
Swiss National Fund (SNF)	72.9	19	87.5	21
Commission for Technology and Innovation (CTI)	33.3	9	30.8	7
Miscellaneous research subsidy funds	19.3	5	25.6	6
Research assignments from federal offices	70.0	19	71.4	17
European research programs	56.0	15	80.1	19
<b>Total third-party funds</b>	<b>125.9</b>	<b>33</b>	<b>121.1</b>	<b>29</b>
Research with private-sector partners	96.4	26	91.7	22
Special funds, gifts/bequests	24.2	6	24.0	6
Other (e.g. cantons, municipalities)	5.2	1	5.4	1
<b>Total</b>	<b>377.4</b>	<b>100</b>	<b>416.4</b>	<b>100</b>

## ETH Domain: Development of Second- and Third-Party Funds



## RESOURCES

## ETH Domain: Development of Second- and Third-Party Funds and Other Revenues as a Percentage of Total Revenues



## Cash Flow Statement

The CHF 423.8 million cash flow from current activities was primarily used to cover capital expenditure requirements of CHF 348.1 million. The remaining free cash flow served mainly to increase liquid assets (CHF 70.5 million). This increase was necessitated by the introduction of the New Accountancy Model (NRM) of the Confederation. Based on this change, the ETH Domain began conducting its payment transactions autonomously as of January 2007. To avoid solvency shortages in the period between the end of 2006 and January 2007, the ETH Domain had to be equipped with the necessary liquidity. The change in the cash fund is integrated in the proof calculation on the derivation of the federal financial contribution.

Noncash deductions of the indirectly calculated cash-flow were considerably more substantial than in 2005. Together with depreciation, the deductions concerned balance sheet transactions in equity or provisions.

Financing activities involved credits from the Canton of Aargau to the Paul Scherrer Institute

of net CHF 8 million. Also, forming reserves from the financial contribution appeared under financing transactions.

## Capital Expenditure Statement

In 2006, capital expenditures totalled CHF 347.8 million. This total is virtually identical to the sum in the 2005 account, and is within the bracket of the long-time average of approximately CHF 360 million. Higher capital expenditure requirements with regard to real estate led to a shift in proportions. The share of construction expenditures increased from 51% in 2005 to 57% in 2006. Expenditures for goods (technical and scientific equipment, and user-specific installations) were CHF 114.3 million (2005: CHF 128.4 million), and CHF 34.3 million went to IT (2005: CHF 42.6 million). Expenditures for movables were at the budgeted level. In contrast, the total of IT expenditures was below the sum budgeted for 2006, and construction expenditures were significantly lower than budgeted (CHF 260.1 million). The deviation from budget was primarily caused by delays and legal stoppages.

The share of movable property, plant, and equipment that was financed with second- and third-party funds was CHF 24.6 million, slightly below the previous year's level of CHF 29 million.

The total of IT and telecommunications (capital expenditures/expenses) was CHF 104.2 million and thus corresponded to the long-time annual average of approximately CHF 100 million.

With the exception of real estate owned by ETH Zurich, real estate is basically owned by the Confederation and is capitalized in its balance sheet.

## ETH Domain: Cash Flow Statement

in CHF m	2005	in %	2006	in %	Diff. in CHF	Diff. in %
<b>Cash flow from current activities</b>						
Net income from income statement	235.9		237.4		1.4	
Depreciation	106.4		119.3		12.9	
Miscellaneous accruals, changes in liabilities	28.9		44.1		15.2	
<b>Cash flow</b>	<b>371.2</b>	<b>16.1</b>	<b>400.8</b>	<b>16.7</b>	<b>29.6</b>	<b>8.0</b>
Increase/decrease in net current assets	-28.4		22.9		51.3	
<b>Cash flow from current activities</b>	<b>342.8</b>	<b>14.9</b>	<b>423.8</b>	<b>17.6</b>	<b>80.9</b>	<b>23.6</b>
<b>Cash flow from capital expenditures</b>						
Expenditures in real estate, equipment, IT	341.0		348.0		6.9	
Financial investments	0.0		0.4		0.4	
Divestments	-4.2		-0.4		3.8	
<b>Net investments</b>	<b>336.9</b>	<b>14.6</b>	<b>348.1</b>	<b>14.5</b>	<b>11.2</b>	<b>3.3</b>
<b>Free cash flow</b>	<b>5.9</b>	<b>0.3</b>	<b>75.7</b>	<b>3.1</b>	<b>69.8</b>	
<b>Cash flow from financing activities</b>	<b>0.0</b>		<b>8.0</b>		<b>8.0</b>	
Recording/write-back of reserves	-4.3	-0.2	13.2	0.6	17.6	-405.4
<b>Residual credit from federal financial contribution at 31 Dec.</b>						
	<b>0.0</b>	<b>0.0</b>				
<b>Derivation of federal financial contribution:</b>						
	<b>2005</b>	<b>in %</b>	<b>2006</b>	<b>in %</b>	<b>Diff. in CHF</b>	<b>Diff. in %</b>
Total expenses	2,082.9	90.3	2,179.8	90.6	97.0	4.7
Net investments	336.9	14.6	348.1	14.5	11.2	3.3
Miscellaneous revenues	-492.5	-21.3	-536.8	-22.3	-44.3	9.0
Miscellaneous accruals, changes in balances	-106.9	-4.6	-194.4	-8.1	-87.5	81.8
Change in cash fund	10.3	0.4	70.5	2.9	60.2	584.9
Change in reserves from federal financial contribution	-4.3	-0.2	13.2	0.6	17.6	-405.4
<b>Federal financial contribution</b>	<b>1,826.3</b>	<b>79.2</b>	<b>1,880.4</b>	<b>78.2</b>	<b>54.1</b>	<b>3.0</b>

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## ETH Domain: Capital Expenditure Statement

in CHF m	2005	in %	2006	in %	Diff. in CHF	Diff. in %
<b>Net total investments</b>	<b>347.0</b>	<b>15.0</b>	<b>347.8</b>	<b>14.5</b>	<b>0.7</b>	<b>0.2</b>
Real estate (owned by the Confederation)	169.3	7.3	199.1	8.3	29.8	17.6
Real estate (owned by ETHZ, EPFL, or research institutions)	6.7	0.3	0.1	0.0	-6.7	-99.3
Equipment (incl. installations)	128.4	5.6	114.3	4.8	-14.1	-11.0
IT	42.6	1.8	34.3	1.4	-8.3	-19.6
<b>Gross total investments</b>	<b>347.8</b>	<b>15.1</b>	<b>348.0</b>	<b>14.5</b>	<b>0.2</b>	<b>0.1</b>
Real estate (owned by the Confederation)	169.3	7.3	199.1	8.3	29.8	17.6
Real estate (owned by ETHZ, EPFL, or research institutions)	6.7	0.3	0.1	0.0	-6.7	-99.3
Equipment (incl. installations)	128.5	5.6	114.5	4.8	-14.1	-10.9
IT	43.2	1.9	34.3	1.4	-8.9	-20.5
<b>Projects costing over CHF 10 million</b>	<b>115.0</b>	<b>5.0</b>	<b>117.4</b>	<b>4.9</b>	<b>2.4</b>	<b>2.1</b>
Real estate (owned by the Confederation)	89.6	3.9	106.3	4.4	16.7	18.7
Real estate (owned by ETHZ, EPFL, or research institutions)	0.0	0.0	0.0	0.0	0.0	0.0
Equipment (incl. installations)	25.4	1.1	11.1	0.5	-14.3	-56.3
IT	0.0	0.0	0.0	0.0	0.0	0.0
<b>Projects costing up to CHF 10 million</b>	<b>232.8</b>	<b>10.1</b>	<b>230.5</b>	<b>9.6</b>	<b>-2.2</b>	<b>-1.0</b>
Real estate (owned by the Confederation)	79.7	3.5	92.8	3.9	13.1	16.4
Real estate (owned by ETHZ, EPFL, or research institutions)	6.7	0.3	0.1	0.0	-6.7	-99.3
Equipment (incl. installations)	103.1	4.5	103.4	4.3	0.3	0.2
IT	43.2	1.9	34.3	1.4	-8.9	-20.5
<b>Revenues from sales</b>	<b>0.7</b>	<b>0.0</b>	<b>0.2</b>	<b>0.0</b>	<b>-0.5</b>	<b>-71.8</b>
Real estate (owned by the Confederation)	0.0	0.0	0.0	0.0	0.0	0.0
Real estate (owned by ETHZ, EPFL, or research institutions)	0.0	0.0	0.0	0.0	0.0	0.0
Equipment (incl. installations)	0.2	0.0	0.2	0.0	0.0	7.2
IT	0.5	0.0	0.0	0.0	-0.5	-96.9

## Real Estate

Construction expenditures in the amount of CHF 199.1 million were undertaken in 2006, although according to the finance plan, capital expenditures of CHF 260.0 million had been foreseen. The difference of CHF 61.0 million (23.4%) resulted mainly from underutilization of budgeted funds at the research institutes. The Swiss Federal Institute for Forest, Snow and Landscape Research (WSL) stopped construction activities almost completely pending reorganization. The Paul Scherrer Institute (PSI) did not fully use monies granted due to legal delays. The difference between the capital expenditure total and the total expenditures from the funding commitments is attributable, in part, to the fact that portions of the "budget for construction costs 3" are covered directly under expenses and are not treated as capital expenditures. Transitory discrepancies also led to differences.

Over the past year, capital expenditures for new construction, in particular, increased. Additional funds were also used to maintain value and functionality of existing structures. Thus,

repairs consumed a considerable portion of expenditures (43.3%). In absolute numbers, expenditures for repairs increased from CHF 78.9 million in 2005 to CHF 90.4 million in 2006.

The funding commitments are structured and transacted according to the budget for construction costs. The projects are carried out using funding commitments secured by the ETH Board through annual construction programs submitted to the Federal Council and Parliament. Approved funding commitments of approximately CHF 1.18 billion were available to the ETH Domain at the end of 2006.

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### ETH Domain: Construction Expenditures

in CHF m	2005	in %	2006	in %	Diff. in %
ETH Zurich	117.9	67.0	131.2	62.7	11.2
EPF Lausanne	23.3	13.2	46.7	22.3	100.3
PSI	9.4	5.4	12.9	6.2	36.6
WSL	1.7	1.0	0.7	0.4	-57.1
Empa	5.2	2.9	10.7	5.1	106.7
Eawag	18.5	10.5	6.9	3.3	-62.7
<b>Total</b>	<b>176.0</b>	<b>100.0</b>	<b>209.0</b>	<b>100.0</b>	<b>18.8</b>

### ETH Domain: Construction Projects

in CHF m	2005	in %	2006	in %	Diff. in %
Acquisition of land and estate	0.6	0.4	0.0	0.0	-93.5
New construction	55.6	31.7	67.1	32.1	20.7
Repair	78.9	45.0	90.4	43.3	14.6
Conversion/expansion	39.5	22.5	51.0	24.4	29.2
Demolition	0.7	0.4	0.5	0.2	-32.0
<b>Total</b>	<b>175.3</b>	<b>100.0</b>	<b>209.0</b>	<b>100.0</b>	<b>19.2</b>

### **New Accountancy Model and Brownfields**

With the launch of the New Accountancy Model (NRM) of the Confederation in 1 January 2007, an inventory and appraisal of the complete real estate portfolio of the Confederation will be carried out using consistent appraisal principles and methods. This process will affect the ETH Domain, as it uses real estate that belongs to the Confederation. Due to this, 2006 was characterized by adjustments in the context of the NRM. This necessitated not only reconceiving the financial management of ETH Domain's real estate, but also the implementation and clearing of monetary transactions, as well as the value management in the financial accounting. For the ETH Domain to achieve this, it was partly possible to use the completed real estate estimate as a foundation. The appraisal concepts of the three construction categories of the Confederation were successfully certified by the Swiss Federal Audit Office (SFAO) in the summer of 2006.

The real estate portfolio used by the ETH Domain is highly heterogeneous, comprising approximately 530 buildings, 270 lots, and a few building leases, with a total combined book

Newly, there is also a quarterly reporting on the monetary transactions.

In a separate project, the brownfields of the ETH Domain were recorded and appraised. These are recorded on the Confederation's balance sheet as provisions and contingent liabilities. The largest provisions, with a total of CHF 300 million, were made for the dismantling of nuclear facilities and disposal. Large sums also resulted from new regulations related to fire prevention and earthquakes, although with regard to the latter there are still few experiences and no concluding appraisal. In the area of brownfields, where restoration programs have been carried out for many years, relatively low sums were determined.

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value of CHF 4.8 billion on the Confederation's balance sheet. Because the Confederation now charges "rent," the calculation of the accommodation funding has to show book value, depreciation, and also annual appreciation according to new criteria. The rental is not financially relevant. Recently, also a quarterly reporting has been introduced on the monetary transactions and the status of the value management by the institutions directly to the Swiss Federal Office for Building and Logistics (SFBL).

## COST AND PERFORMANCE ACCOUNTING

At the two Federal Institutes of Technology, it is not yet possible to break down costs by the core products teaching, research, and services. At the research institutions, a transparent representation by core products and areas of focus has already been implemented.

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Costs at ETH Zurich are reported for 2006 by department, while EPF Lausanne reports by faculty. The allocation of costs to teaching, research, and services at the two Federal Institutes of Technology has not yet been implemented. This means that the objectives and instructions of the ETH Board, the Swiss Federal Statistics Office (SFSO), and the State Secretariat for Education and Research (SER) are not yet being fulfilled. At the same time, work on the cost-accounting model of the Swiss University Conference (SUC) is rather advanced. Its objectives correspond to a large degree with the requirements of the ETH Board and the SFSO and SER. The source data used by the two Federal Institutes of Technology to prepare 2006 cost-accounting statements are analogous to the data provided to the SUC. In addition, at the research institutes, costs for 2006 are broken down by areas of focus and core products, as they were the previous year.

Total costs at ETH Zurich for 2006 amounted to CHF 1,131.6 million (CHF 1,110.6 million in 2005). This figure includes direct costs of CHF 743.5 million as well as indirect costs of CHF 388.2 million. As a result of the further refinement of compilation, there was a slight shift toward direct

costs, from 65% in 2005 to 66% in 2006. The remaining 34% in indirect costs was allocated to the departments in proportion to their respective staff costs.

All costs not necessary for performance generation – that is, costs not related to the operational purpose – were treated as accrued items. The costs to be excluded as nonoperational totalled approximately CHF 273 million. To attain a degree of comparability between the two Federal Institutes of Technology, the factual criteria that govern accruals of nonoperational costs were coordinated between ETH Zurich and EPF Lausanne. The sum per department at ETH Zurich and per faculty at EPF Lausanne are regarded as reliable values, because these are costs for performance generation per unit, not to be confused with cost per product (i.e., teaching, research, and services).

Staff costs were used as the basis for determining allocations to the receiving units at the two Federal Institutes of Technology. This is the case both for entered costs that have to be allocated, as well as for separately presented occupancy expenses. The further allocations also include occupancy expenses of allocated central

units. All units at ETH Zurich that are organizationally outside of the departments and are directly involved with research and teaching are subsumed under "Interdisciplinary."

The change in provisions for pending projects was treated as a nonoperational accrued item. Changes in internal performance commitments are treated similarly. In addition, scholarships are treated as transfer payments. Further accruals relate to energy deliveries by ETH Zurich.

The cost increase at ETH Zurich was related to the development of system and molecular biology in the Biology Department, among other sources. While the shift of the Swiss Economic Institute (KOF) with a cost volume of CHF 4.4 million resulted in a reduction of costs in the Humanities, Social, and Political Sciences Department, it generated a corresponding increase in interdisciplinary costs. Information on how the larger output volume was financed is provided in the Financial Accounts and the Cash Flow Statement.

The High-Performance Computing Centre (CSCS) in Manno is used intensely by organizations outside ETH Zurich. The corresponding

2006 came to CHF 481.9 million (2005: CHF 444.6 million). The core product research showed the largest growth with an increase of CHF 27.8 million to CHF 354.4 million. Compared to that, services stayed practically constant at the previous year's value, equaling CHF 71.6 million (2005: CHF 68.7 million). Within the individual research institutes, there were no marked shifts compared to the 2005 accounting.

costs are treated as a nonoperational accrued item. Accruals were also needed for central services for third parties by the ETH Zurich library.

At EPF Lausanne, the Faculty of Life Sciences was the main source of growth, while the other faculties stayed approximately at the previous year's level. This is in keeping with EPF Lausanne's portfolio strategy. Total costs were CHF 585.8 million (compared to CHF 577.9 million in 2005). The proportion of direct costs was 67%, in alignment with the previous year and slightly higher than at ETH Zurich.

A higher output volume was transacted or generated at EPF Lausanne compared to the 2005 accounting. Part of the cost increase is related to rising prices. Details regarding the financing of the output are disclosed in the Financing Statement.

The research institutes again broke down costs not only by areas of focus, but also by the products teaching, research, and services. At the Swiss Federal Institute for Forest, Snow and Landscape (WSL), the areas of focus were also kept constant, although a reorganization with potential changes in areas of focus is under way at WSL. Total costs at the research institutes for

## ETH Zurich: Costs by Department, 2006

in CHF m	Personnel costs <sup>1</sup>	Material and misc. costs <sup>1</sup>	Depreciation <sup>1</sup>	Over-head <sup>2</sup>	Occupancy <sup>2</sup>	Total
Mathematics	25.3	1.6	0.0	10.4	2.4	39.8
Physics	51.2	18.0	4.1	21.1	13.2	107.6
Chemistry and Applied Biosciences	67.1	11.5	9.3	27.7	23.1	138.7
Biology	57.7	12.4	4.3	23.8	12.9	111.1
Humanities, Social and Political Sciences	23.5	5.1	0.2	9.7	2.5	41.0
Architecture	35.3	5.4	0.5	14.5	6.6	62.2
Construction, Environment and Geomatics	48.2	5.4	1.3	19.9	13.5	88.4
Management, Technology and Economics	17.8	2.3	0.1	7.3	1.9	29.4
Mechanical and Process Engineering	48.5	5.8	4.1	20.0	15.0	93.3
Information Technology and Electrical Engineering	46.6	5.3	2.6	19.2	10.6	84.2
Informatics	33.1	2.1	0.4	13.6	4.6	53.8
Materials Science	21.5	2.7	2.5	8.9	5.6	41.2
Agricultural and Food Sciences	32.6	5.9	1.8	13.5	12.7	66.4
Earth Sciences	28.9	4.7	2.3	11.9	5.5	53.4
Environmental Sciences	41.3	5.2	1.6	17.1	7.8	73.0
Interdisciplinary	20.7	10.6	5.2	8.5	3.0	48.1
<b>Total</b>	<b>599.2</b>	<b>104.1</b>	<b>40.2</b>	<b>247.2</b>	<b>140.9</b>	<b>1,131.6</b>

<sup>1</sup> Directly allocated costs:  
743.5

<sup>2</sup> Indirectly allocated costs  
388.2  
(reclassification)

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## EPF Lausanne: Costs by Faculty, 2006

in CHF m	Personnel costs <sup>1</sup>	Material and misc. costs <sup>1</sup>	Depreciation <sup>1</sup>	Over-head <sup>2</sup>	Occupancy <sup>2</sup>	Total
<b>Basic Sciences</b>	<b>106.1</b>	<b>12.6</b>	<b>9.0</b>	<b>30.5</b>	<b>34.2</b>	<b>192.4</b>
Mathematics	19.3	1.4	0.2	5.6	3.3	29.8
Physics	57.8	7.8	5.0	16.6	18.0	105.2
Chemistry	29.0	3.4	3.8	8.3	12.9	57.4
<b>Construction, Architecture and Environment</b>	<b>56.5</b>	<b>6.1</b>	<b>1.7</b>	<b>16.3</b>	<b>19.5</b>	<b>100.0</b>
Civil Engineering	21.7	2.1	0.8	6.2	9.4	40.2
Architecture	20.1	1.5	0.2	5.8	5.4	33.0
Agricultural Engineering	14.7	2.4	0.7	4.2	4.6	26.8
<b>Engineering Sciences</b>	<b>93.8</b>	<b>10.3</b>	<b>5.1</b>	<b>26.9</b>	<b>28.0</b>	<b>164.1</b>
Microengineering	24.9	3.3	2.0	7.2	7.1	44.5
Electrical Engineering	26.3	1.9	1.1	7.6	6.1	43.0
Mechanical Engineering	21.2	2.3	0.7	6.1	7.7	38.0
Materials Science	20.0	2.4	1.2	5.8	7.0	36.4
Biomedical Engineering	1.3	0.5	0.1	0.4	0.1	2.3
<b>Computer and Communication Sciences</b>	<b>39.8</b>	<b>3.4</b>	<b>0.8</b>	<b>11.4</b>	<b>8.4</b>	<b>63.9</b>
Informatics	21.9	2.0	0.4	6.3	4.8	35.5
Communication Systems	17.9	1.4	0.4	5.1	3.6	28.4
<b>Life Sciences</b>	<b>27.6</b>	<b>7.6</b>	<b>4.9</b>	<b>7.9</b>	<b>6.2</b>	<b>54.1</b>
Life Sciences	22.1	5.9	3.5	6.3	5.0	42.7
Biomedical Engineering	5.5	1.7	1.4	1.6	1.2	11.4
<b>Humanities and Social Sciences</b>	<b>7.5</b>	<b>0.4</b>	<b>0.0</b>	<b>2.2</b>	<b>1.2</b>	<b>11.3</b>
Technology Management	7.3	0.3	0.0	2.1	1.1	10.8
Technology Management	0.3	0.0	0.0	0.1	0.0	0.4
<b>Total</b>	<b>331.4</b>	<b>40.3</b>	<b>21.6</b>	<b>95.2</b>	<b>97.4</b>	<b>585.8</b>

<sup>1</sup>Directly allocated costs:  
393.2

<sup>2</sup>Indirectly allocated costs:  
192.6  
(reclassification)

## Research Institutes: Cost/Product Accounting, 2006

in CHF m	Teaching	Research	Services	Total
<b>Research institutes and areas of focus</b>				
<b>PSI</b>	<b>31.1</b>	<b>196.7</b>	<b>17.3</b>	<b>245.1</b>
Particle physics and astrophysics	6.6	37.5	0.0	44.1
Biosciences	4.4	37.5	2.2	44.1
Solid-state and materials science	15.1	80.4	5.0	100.5
Nuclear energy and safety	2.4	19.7	7.4	29.4
General energy and energy-related environmental sciences	2.7	21.6	2.7	27.0
<b>WSL</b>	<b>7.4</b>	<b>39.0</b>	<b>15.1</b>	<b>61.5</b>
Forest	1.8	10.8	4.0	16.6
Landscape	3.3	16.2	2.7	22.1
Natural hazards	2.3	12.1	8.4	22.7
<b>Empa</b>	<b>7.7</b>	<b>76.0</b>	<b>27.2</b>	<b>110.9</b>
Modern materials, surfaces and boundary layers	2.3	21.0	4.5	27.8
Materials and systems for the comfort and protection of the human body	0.7	10.8	3.4	14.9
Materials and systems for construction and engineering	2.3	19.5	11.2	33.0
Information, reliability and simulation engineering	1.5	12.6	3.6	17.7
Mobility and environment	0.9	12.1	4.5	17.5
<b>Eawag</b>	<b>9.7</b>	<b>42.7</b>	<b>12.0</b>	<b>64.5</b>
Environmental protection	4.2	17.2	7.5	28.8
Social structures and relationships	0.4	4.2	0.6	5.2
Study and utilization of the earthly environment	5.1	21.3	4.0	30.4
<b>Total</b>	<b>56.0</b>	<b>354.4</b>	<b>71.6</b>	<b>481.9</b>

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### National Comparability of Data on Cost/Performance Accounting 2005

The Swiss University Conference (SUC) pressed ahead with work on cost/performance accounting in 2006, with the long-term goal of comparing costs and performance between universities. The main results of cost accounting 2005 were presented by the steering committee of SUC in December 2006. The results of the cost/performance accounting 2005 were published in March 2007.

The SUC analysis differentiates between Teaching, Research, Further Education, and Services as main cost units. Within this framework, costs per student are identified, as well as all costs and earnings in research and teaching per academic department. In addition, comparable mentoring quota (faculty and instructional staff members/students) are produced.

The ETH Domain has major reservations regarding the interpretation of the results of the cost/performance accounting 2005. In particular, the ETH Board recommends that costs are evaluated by department group rather than by

department. This would help to avoid the problem of performance transfers between individual specializations. As the analytical performance accounting 2005 in its present form can lead to misinterpretation or erroneous conclusions, the ETH Board abstains from its publication.

The Swiss Federal Statistical Office (SFSO) reports annually on the development of the various departments in its Education and Science report series. The data for the two Federal Institutes of Technology derive from the respective cost accounting of these universities. The table below shows the cost components per department group for 2005. Corresponding data for 2006 are expected in the second half of 2007.

### 2005 Assessment by Academic Department Groups

in CHF m	ETH Zurich			EPF Lausanne			Total
	Personnel	Operating	Total	Personnel	Operating	Total	
Humanities, social and political sciences	21.8	6.5	28.2	0.3	0.0	0.3	28.5
Economic sciences	5.5	0.6	6.1			0.0	6.1
Law	2.1	-0.1	2.0			0.0	2.0
Exact and natural sciences	268.4	75.8	344.2	139.7	46.2	185.9	530.0
Medicine and pharmacy	11.4	7.5	18.9			0.0	18.9
Technical sciences	262.9	46.2	309.1	166.7	36.4	203.1	512.2
Interdisciplinary and other	11.0	6.3	17.2	11.7	6.9	18.6	35.8
Central administration	71.2	80.5	151.8	33.2	34.2	67.4	219.1
Central libraries	20.2	21.7	41.9	2.4	2.0	4.4	46.3
Technical services and logistics	38.3	74.2	112.5	16.4	38.2	54.5	167.1
Services for staff and students	4.0	5.8	9.8	1.0	0.5	1.5	11.3
<b>Total</b>	<b>716.7</b>	<b>324.9</b>	<b>1,041.7</b>	<b>371.3</b>	<b>164.3</b>	<b>535.6</b>	<b>1,577.3</b>

(Source: Volume 15, Finances of Academic Universities, Swiss Federal Statistical Office [SFSO])

## ACCOUNTING PRINCIPLES

The accounting principles of the ETH Domain are based on the general principles of the ETH Board's accounting rules and on generally accepted commercial bookkeeping principles. The annual accounts include all asset, equity, and income figures according to the "true and fair view" principle.

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## RESOURCES

### Entity Reporting Structure

The ETH Domain's entity reporting structure comprises the following entities:

- The Board of the Swiss Federal Institutes of Technology (ETH Board), Zurich
- ETH Zurich (ETHZ), Zurich
- EPF Lausanne (EPFL), Lausanne
- The Paul Scherrer Institute (PSI), Villigen
- The Swiss Federal Institute for Forest, Snow and Landscape Research (WSL), Birmensdorf and Davos
- The Swiss Federal Laboratories for Materials Testing and Research (Empa), Dübendorf, St. Gall, and Thun
- The Swiss Federal Institute for Environmental Science and Technology (Eawag), Dübendorf and Kastanienbaum

### Consolidation Principles

- The ETH Domain belongs to the Swiss Confederation and is situated in the third circle of the "four-circle model." Consolidation of capital is not necessary, as the ETH Domain was not endowed with equity capital. Only interentity claims and debts were mutually offset, to the amount of CHF 2.2 million.
- Foreign currencies are translated at the Federal Financial Administration exchange rate on the statement date. Exchange rate gains and losses are not posted.
- Investments in enterprises are permitted under the Intangible Assets and Investments Regulation (SR 414.172), IGBV-ETH (Chapter 2, Articles 9 to 18) of 24 March 2004. In the accounts of the individual institutions, only provisional values for such holdings may be carried. The investment schedule according to Article 16, Paragraph 6, of the ETH Domain Regulation (SR 414.110.3) was published in Appendix E Special Accounts section of the state accounts 2006.

- There are no interentity profits within the ETH Domain. Due to the small volume of intra-Domain transactions (roughly CHF 8 million according to a 2006 statistical survey), these transactions are not mutually offset.

#### Valuation Guidelines

- Valuations are undertaken in accordance with the November 2006 version of the Accounting Manual.

#### Restatement

##### Balance sheet

- Empa carried out two reclassifications: CHF 0.5 million within current assets and CHF 0.5 million between liabilities and tied capital. These processes had no impact on the balance sheet total 2005 or on equity.

##### Income statement

- A restatement resulting in neither profit nor loss was carried out in the form of an adjustment between the position "changes in provisions" within the extraordinary expenses (CHF -49.9 million) and the newly created

position "changes in performance commitments" (CHF +49.9 million) within ordinary expenses.

##### Cash flow statement

- A net restatement of CHF -0.2 million (CHF +0.5 million ETH Board and CHF -0.7 million Eawag) resulted from corrections between the cash flow from financial activities and ordinary activities. These processes had no material impacts within the cash flow statement.

#### Further Balance Sheet Information

- The evolution of the gross property, plant, and equipment and accumulated depreciation account balances are disclosed in the financial statements of the individual entities (capital expenditure schedule).
- Calculation of changes in capital can be seen in the financial statements of the individual entities.
- The ETH Domain has a small number of off-balance-sheet leasing liabilities (CHF 2.1 million).

#### Internal Performance Commitments (Own Funds)

Only financially relevant internal performance commitments based on own funds have been capitalized. The total obligations from internal performance commitments (from a commercial perspective) are structured as follows:

- Performance commitments vis-à-vis elected professors and for teaching and research projects:

Posted with financial effect as	
per balance sheet	CHF 89.5 million
Uncapitalized portion of	
performance commitments	CHF 65.9 million
Total internal performance	
commitments	CHF 155.4 million

- Performance commitments from construction projects at Empa:

Posted with financial	
effect as per balance sheet	CHF 6.1 million

The details of each commitment are presented in the state accounts (in the Special Accounts section).

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#### Cash Flow Statement

- Cash flow from ordinary activities was calculated by the indirect method.
  - Composition of the cash and cash equivalents account (cash, postal, and bank accounts, short-term securities)
- |                  |                |
|------------------|----------------|
| Opening balance: | CHF 14,251,019 |
| Closing balance: | CHF 84,704,252 |
| Increase:        | CHF 70,453,233 |

#### Extraordinary Pending Transactions and Risks

- No provisions have been made for potentially insufficient reserves in federal retirement systems.
- Provisions have been made and liability and property insurance purchased to cover potential risks in connection with sustaining damage.

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### **Contingent Liabilities (Sureties, Guarantees, Pledges)**

- Aircraft accident (the provision in relation to a pending litigation of ETHZ was reduced from CHF 3.2 million to CHF 1.0 million)
- Deficit guarantee of Empa of CHF 0.03 million to the day nursery
- Further pending litigation concerns ETH Zurich's and Eawag's appeal of an order relating to a supplemental claim for matching AHV/IV/E0/-ALV contributions (provision of CHF 1.26 million)

### **Risk Situation and Risk Management**

The Federal Institutes of Technology and research institutes have obtained property and liability insurance to cover potential losses as part of their risk management programs. Insurance sums are CHF 50 million in the majority. In addition, ETH Zurich insured its own real estate against

potential fire damage. To some extent, financially relevant and nonfinancially relevant provisions for individual loss risks were also made.

### **Rounding Rules**

All figures are calculated according to commercial rules so that small differences are possible in individual sums or subtotals.



## +++++ Addresses in the ETH Domain

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