

Master Environmental Engineering



Protecting our Built and Natural Environment

The ETH Master programme in Environmental Engineering provides a high quality university education, paving the way to leading positions in the fields of water protection and soil conservation, air quality, assessment and sustainable management of resources, and monitoring, control and remediation of pollution. Students are trained in analyzing environmental systems and finding engineering solutions to environmental problems. They learn how to develop technical measures to both prevent and solve problems related to water, soil, air and waste. Emphasis is placed on communication and collaboration across disciplinary boundaries.

The two-year Master programme develops theoretical knowledge and practical problem-solving skills in a range of environmental engineering fields. During the first three semesters students attend courses in one of the five study directions: urban water management, environmental technologies, resource management, water resources management, and river and hydraulic engineering. Flexibility in choosing courses allows students to deepen their knowledge in their core specialisation (major) and at the same time broaden their perspectives in other fields of environmental engineering. Hands-on experience is gained through a range of connected laboratory exercises, field measurements, and computer programming tasks. The acquired problem-solving skills are put to practice in a Master Project work during the third semester. The fourth semester is devoted to the Master Thesis which is a 6-month independent research project supervised by one of the professors in the environmental engineering curriculum.

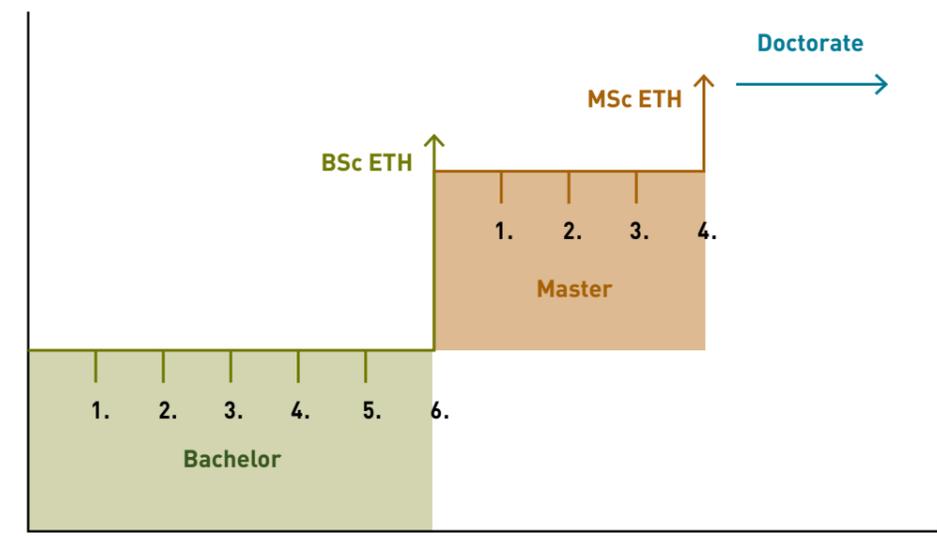
Upon completion of the study programme, graduates are equipped with the tools which enable them to actively participate in the planning and execution of environmental projects, as well as in the running and controlling of complex infrastructure systems, be they in research, engineering companies, public administration or international cooperation.

The Master programme in Environmental Engineering is offered by the Department of Civil, Environmental and Geomatic Engineering (D-BAUG), ETH Zurich, in parallel with Master programmes in Civil Engineering, Geomatics as well as Spatial Development and Infrastructure Systems.

Academic Title

Graduates in this Master programme acquire the academic title Master of Science ETH in Environmental Engineering (MSc ETH Env Eng).

Curriculum structure



The Environmental Engineering curriculum at ETH Zurich follows the international two-stage standard model of Bachelor and Master programmes. Programmes of study completed at ETH are assessed according to a credit point system. The credit point system at ETH Zurich is aligned with the European Credit Transfer System (ECTS).

The programme in Environmental Engineering at ETH Zurich is based on a standard period of study of ten semesters, i.e. five years. It is divided into: a six-semester Bachelor programme and a four-semester Master programme, and may be followed up by doctoral studies at universities world-wide.

Duration of Master Programme

The Master of Science in Environmental Engineering is a full-time study programme during which 120 credit points ECTS must be acquired to obtain the Master degree. The programme begins every autumn and is designed to be completed within four semesters. One year of study comprises two semesters of 14 weeks duration each. One credit point corresponds to a 25–30 hour workload for the student.

Language of Instruction

Compulsory courses are in English, some electives are in German.

Programme Structure and Contents

Majors

The Master of Science programme allows students to choose one of the following majors:

- Urban Water Management
- Environmental Technologies
- Resource Management
- Water Resources Management
- River and Hydraulic Engineering (partly in German)

Courses

The Master of Science programme consists of a minimum of 68 credits obtained by coursework. Courses are organized into thematic modules consisting of 9 credit points. Each major consists of four mandatory and two freely selectable modules. In addition, students can choose a minimum of 12 credits from elective courses which can be freely selected from the ETH Zurich or the University of Zurich course catalogues. Furthermore, all Master students at ETH Zurich are obliged to take at least 2 credit points of courses in the area of humanities, social and political sciences. This setup allows for a focussed but flexible choice of study and a rounded education.

Experimental and Computer Laboratory

The Lab provides hands-on experience in laboratory work, sensor technology, field measurements, and computer modelling. In the Lab students strengthen their practical skills in their chosen modules, deal with measuring, monitoring techniques, mathematical models, and become familiar with software used professionally and in research. The Lab is spread over 2 semesters and consists of 10 credit points.

Master Project

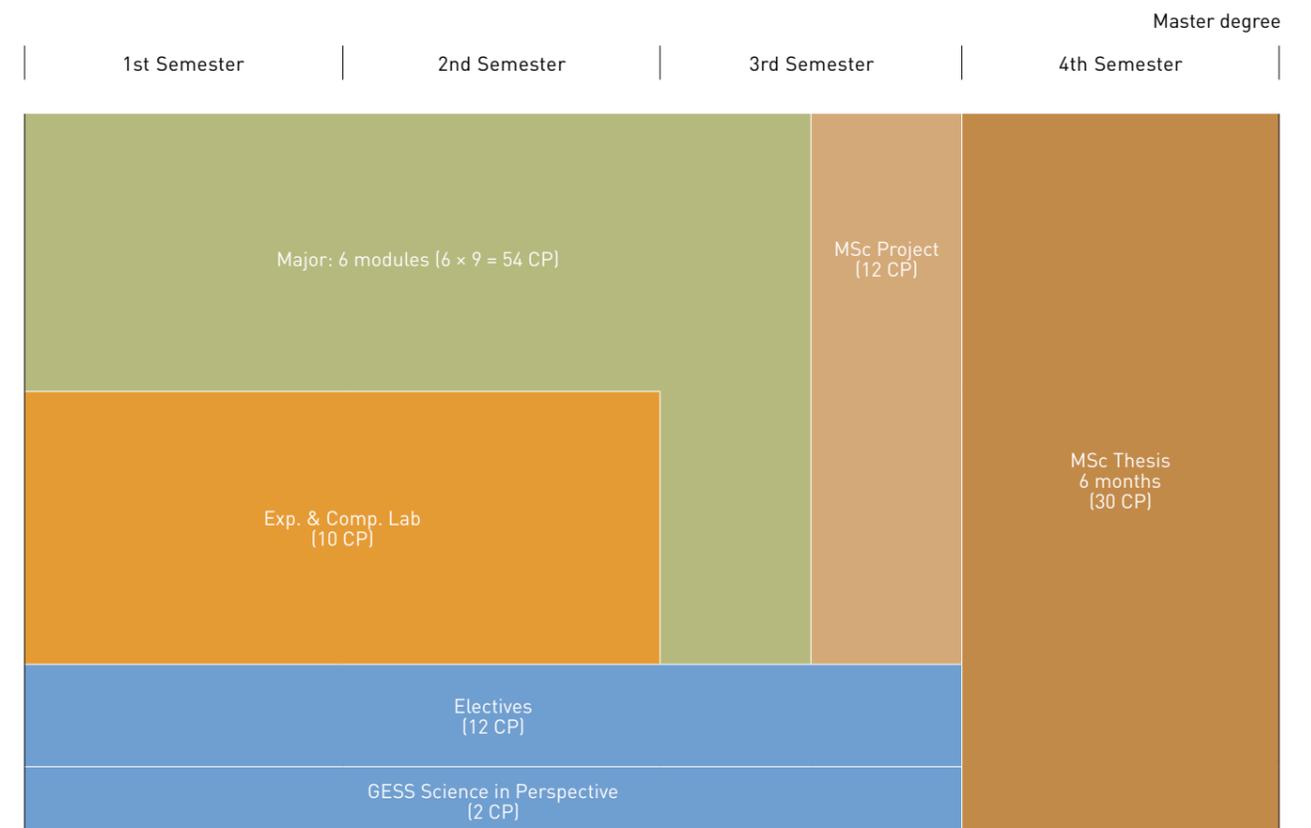
The Master Project in the third semester (12 credit points) is conducted in one of the chosen modules under the supervision of a professor. It aims to apply problem-solving skills and independent learning in a relevant subject within one of the modules. It is ideally conducted in groups and in connection with external partners (private companies, administration offices, etc.) and prepares the students for their Master Thesis.

Master Thesis

The final semester, with a duration of 6 months, is devoted to the Master Thesis (30 credit points). The topic of the Master Thesis must fall within one of the chosen modules in the student's major. In the thesis the student is expected to formulate clear research questions and investigate them with the appropriate scientific tools in his/her discipline, demonstrating creativity and independence in conducting research and finding solutions. The Master Thesis research work is defended in a public presentation.

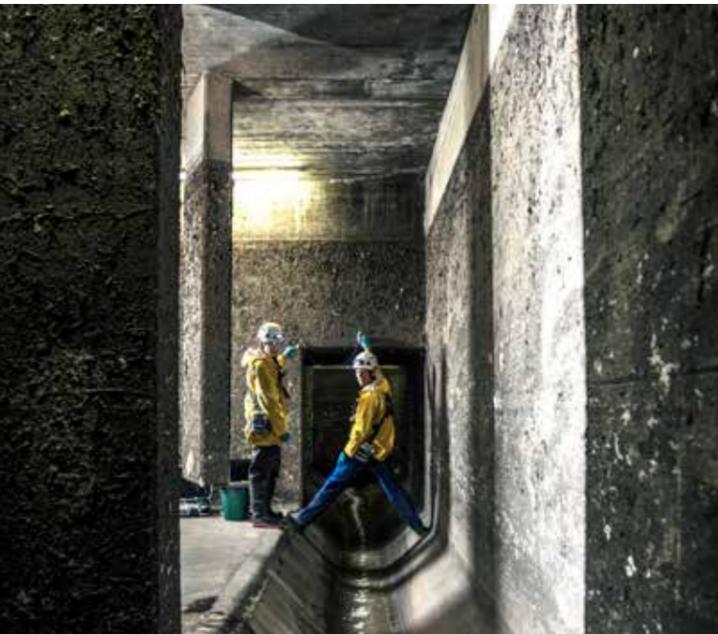
Entrance requirements

Candidates with a Bachelor degree in Environmental Engineering obtained at ETH Zurich, EPF Lausanne or at one of the IDEA League Partner Universities are admitted to the Master programme without any additional requirements. Candidates holding a Bachelor degree with at least 180 ECTS or an equivalent degree in environmental engineering obtained at another university can apply to join the Master programme. These applications will be reviewed by a selection committee that decides on the admission on the basis of merit and grades, and may suggest additional courses to be taken as prerequisites.



Exp. & Comp. Lab = Experimental and Computer Laboratory (year course)

Majors



Urban Water Management

In the core area Urban Water Management students study modern concepts for managing and controlling water flows in cities. The study areas focus on water resources, water supply, urban hydrology, urban drainage, wastewater treatment, and sustainability and evaluation concepts. Courses at the master's level are focused on fundamentals of biological and physical/chemical treatment processes, on water systems analysis, and on infrastructure management. Through coursework and practical experience in the Master project and the thesis students gain a solid basis for developing innovative solutions in urban water management.

Sensors in the drains
Photo: Kellenberger Kaminski Photographie, © ETH-Rat

Environmental Technologies

The Environmental Technologies profile consists of four required modules: Air quality control, Process Engineering in Urban Water Management, System Analysis in Urban Water Management, and Waste Management. The goal of the profile is to equip students with in-depth knowledge on air quality control, urban water management, wastewater and drinking water treatment, and solid waste treatment and recycling. The graduates of this profile are expected to possess strong engineering capabilities and knowledge of advanced technologies to solve practical problems, thereby providing clean air, clean water and a clean urban environment for society.



Wind tunnel for air handling and nanoparticle transport studies
Photo: © Jing Wang, Empa



Metal waste collection facility
Photo: © Melanie Haupt

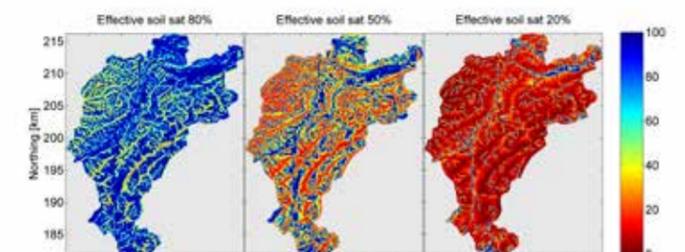
Water Resources Management

This major is focused on understanding, modelling and monitoring of hydrological processes and systems at a range of spatial scales from microscale to catchment scale and on the management of water resources. Students learn about the functioning of the water cycle and the assessment of water resources through data analysis and modelling, the theory and applications of subsurface and surface flow in rivers and aquifers, rainfall-runoff transformation, precipitation extremes and floods, sediment fluxes in fluvial

Resource Management

This major equips students with the knowledge skills to manage resources sustainably, to prevent resource scarcity and minimize environmental impacts. Students learn to understand, model and assess material cycles and waste management, water cycles, and energy systems. Within the elective modules, students can deepen their knowledge in additional resource types, such as land, soil and air. Graduates are expected to be able to solve complex problems and answer strategic questions from a system-oriented perspective. This includes applying environmental assessment methods and modeling tools for technology assessment and improvement.

systems including ecological effects, and water resources management and optimal allocation. The core subjects cover the tools required for the planning and operation of water resources, for the assessment and management of hydrologic and hydraulic risk, as well as for river engineering and river ecology.



Soil saturation simulated by a physically-based watershed model
Photo: © Peter Molnar

River and Hydraulic Engineering

The major River and Hydraulic Engineering provides students with knowledge on hydraulic systems and their structural and operational aspects which is needed for an environmentally sound management of water resources. Emphasis is placed on planning, design and operation of hydropower plants, dams and flood protection measures. The major also includes fluvial hydraulics and river engineering, the restoration of rivers, and natural hazard management. The acquired knowledge is crucial for urgent national challenges such as hydropower development within the Swiss energy strategy 2050 or the rehabilitation of hydropower plants, as demanded by the Swiss Waters Protection Act. The latter requires the improvement of river morphology and ecology in Switzerland.



Water intake and fish passage facility of the hydropower plant Trins at Gschnitzbach in Tyrol, Austria
Photo: © Robert Boes, VAW

Optional modules & lab

Remote Sensing and Earth Observation module

Remote Sensing of the Earth surface is building bridges between different disciplines and uses space and airborne sensors as a tool to monitor and quantitatively estimate biophysical- and geophysical environmental information products. How these products are derived and from which sensors they are obtained is the core learning objective of this module. Focus is given to regional as well as global estimation of datasets for flood detection, crop growth monitoring, soil moisture estimation, derivation of digital elevation models for terrain correction and geocoding, deformation estimation, forest parameter estimation, mass balance of glacier and ice sheets, etc. Remote sensing products are a valuable information source for the understanding of environmental issues and as support for planning and decision making.



Glacier change detection
Photo: © Irena Hajnsek



Students conducting field soil water measurements
Photo: © STEP, ETH Zürich

Soil module

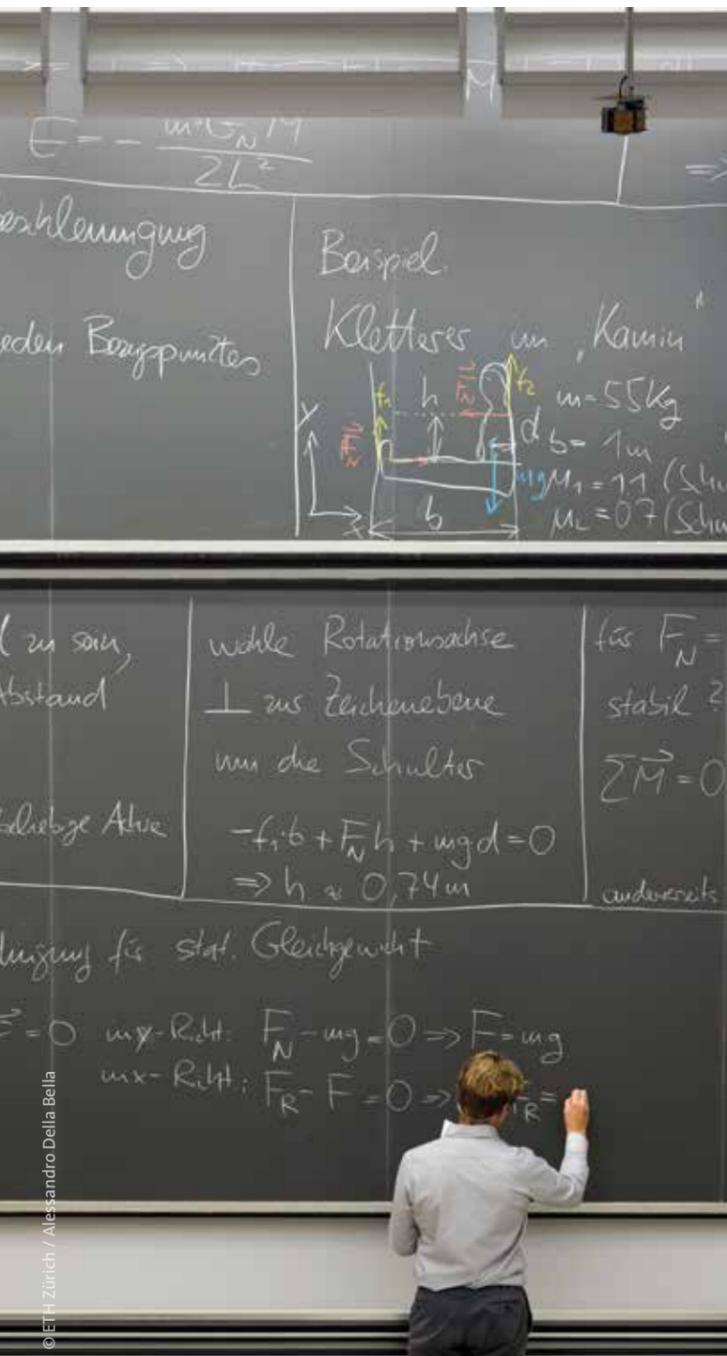
Soil serves as the interface between the biosphere, atmosphere, lithosphere and hydrosphere where it supports plants (the largest stock of biomass) and provides other key provisional and regulatory ecosystem services ranging from element cycling to water purification. The function and unique characteristics of this thin film of life that covers terrestrial surfaces can only be understood by systematically studying the links between the physical, chemical and biological components of soil. The soil module offers a suite of theoretical and experimental approaches to quantify soil properties and key processes and their roles at different scales. Students learn to better understand the role of soils in hydrology, climate, natural hazards, and the role of soil protection and sustainable land use in society.



Experimental and Computer Laboratory

Measurements are an important basis to quantify the human impact on our environment. In the Experimental and Computer Laboratory the students learn in hands-on projects how relevant environmental parameters are measured and how this acquired data has to be processed to result in environmentally relevant information. Key learning targets are sensor-based data acquisition, handling data with medium and large measurement uncertainties, and model-based evaluation of measurement results. Depending on the topic, the experimental part of the projects are carried out in the lab or as fieldwork.

Skills required to succeed at ETH



Initiative and perseverance

Studies at ETH are demanding. The Master of Science programme consists of topically focussed courses which build upon the basic knowledge gained in the Bachelor programme. The courses concentrate on current high-level research results and complex problem-solving. To succeed and learn in this environment, you must show continuous initiative and willingness to learn. Perseverance is necessary to overcome periods in the semester with heavy workloads. It is important to challenge yourself and ask questions. Your instructors will expect and welcome your initiative, in class and outside of it.

Get to know ETH and be prepared

Students who have not completed their Bachelor at ETH will at first likely find many things new and confusing. Approach your fellow students who have studied at ETH if you have questions about the study culture, expectations of the instructors, different forms of exams. The oral exam format may initially be new and stressful for you at first. Your fellow students will be happy to give you advice on how to prepare for examinations. Have your questions answered as soon as possible after you begin your studies. Foreign language speakers should take advantage of many opportunities to learn German, which is the best way to integrate in the community and relate to your fellow students.

Schedule your time well

Good time management is a key to success in your studies. Preparation and revision during the semester allows you to spread your workload and truly understand and internalise the studied topics. Many courses will have exercises which will help you to better understand the theory presented in the lectures. You will find many private and quiet places at ETH where you can read and study during the day when you have free time between lectures, and student computer labs where you can work on your exercises. Scheduling your time well means you will avoid burnout at the end of the semester, and will enjoy your studies and free time more.

Teamwork is key to success

Group work is common in classes at ETH and you cannot avoid it. It is expected that you actively engage in group work, opt to lead groups, discuss with fellow students, and learn to defend your own ideas. This prepares you for future jobs where teamwork is key. Furthermore, teamwork allows you to challenge your own knowledge compared to peers, and improve your own skills as a result. Students at ETH are very also well organized and networked at a social level (e.g. in student organisations). It is advisable that you join and actively participate in these networks.



Professional Career as Environmental Engineer

Environmental engineers collect data in the field and in the laboratory utilizing the most up-to-date methods. They analyze these data using mathematical models. They make predictions and propose solutions on the basis of theoretical knowledge and computer simulations. They are trained to quantify the robustness of their methods and design.

Jobs

Environmental engineers find jobs in

- private engineering companies and consulting offices
- environmental divisions of local, regional, and national administration offices
- water and wastewater treatment plants
- companies developing environmental technologies
- NGOs and offices dealing with the environment
- research at universities and in the private sector

Skills

Environmental engineers have the following skills

- Broad theoretical knowledge
- Capability to work in an interdisciplinary way
- Critical and quantitative thinking and problem solving
- Advanced computer and data analysis skills
- Ability to work in an international setting
- Communication and report-writing skills
- Commitment and social responsibility



Typical Tasks

- Planning and implementation of projects, including environmental performance and environmental impact assessment
- Planning, maintenance, renewal and operation of water supply, sewage and waste disposal systems
- Projects aimed at the protection of the natural environment and the quantification of ecosystem services
- Projects aimed at sustainable management of water, soil, biomass, and mineral resources, and remediation of polluted and degraded environments
- Planning and implementation of flood protection projects and natural hazard mitigation activities
- Development of watershed management plans
- Prediction of anthropogenic and climate change impacts on hydrological systems
- Indoor and atmospheric air quality control
- Monitoring of the environment including remote sensing methods and in-situ measurement
- Analysis, assessment and reduction of risks to the environment and society

Alumni

Valentin Müller

magma AG, Schaffhausen



My job

The magma AG is a small company for geology, planning and environment. As an environmental engineer I work at the branch office in Schaffhausen dealing with many different projects. My duties include, among others, environmental impact studies, computation of traffic noise, the investigation of polluted areas, or the consultation for excavations on contaminated sites. Very often these works require the use of Geographic Information Systems (GIS), which I either use simply for visualization purposes, but frequently also for the processing of spatial information or for doing spatial calculations.

What I like about my job

A big advantage of a smaller company is the ability to work independently even as a young staff member. Nevertheless, I can always ask my more experienced colleagues if there are any problems or questions. I also appreciate the fact that I can often do field work, to collect soil samples on contaminated sites, for example.

How my studies at ETH have benefited me

During my studies I acquired a broad knowledge in many fields of environmental engineering. This allows me to work on projects and tasks in a large variety of subjects. At the ETH, I learned to first quickly understand the fundamental concepts of new subjects, and then to look deeper into the details. This is a particular asset for projects I work on and manage by myself.

My advice

A great opportunity during studies is to do an internship. In my case, I not only learned very much from real life, but I also had the opportunity to get an idea about later career choices, such as regarding specific area of work and company size. I advise students who have not yet completed their internship, to choose a company which provides insight in different subjects. Another advice is not to take things like "networking" during the studies too seriously. During both my studies and work, I got the impression that their benefits are often highly overestimated.

Caroline Wildbolz

myclimate Foundation, Department
of Carbon Management Services, Zurich



My job

In my position I support clients from industry and service sectors to verify and optimize the environmental quality of their products. In my work I use the methods of carbon footprinting and life cycle assessment. I support the clients throughout their projects from acquisition, to the evaluation process and the analysis of data, and communication of the results. Our customers come from various sectors and provide a diverse range of projects from new subject areas and with new processes for evaluation. Visiting clients' product or service operations enables me to gain the indispensable understanding of the matter being assessed. Client meetings and attendance at conferences provide an important change from the normal workday.

What I like about my job

My position offers me the opportunity to gain insight into various subject areas and to provide essential analysis to improve the basis for decision-making for a more sustainable system. In addition, the atmosphere at work is supportive and relaxed. myclimate is a young and dynamic employer, with a strong collegial atmosphere.

How my studies at ETH have benefited me

Through the breadth of my studies I learned to connect different topics and results while examining them critically. The fast incorporation of new subject areas, as is required in the degree at the ETH, equipped me with invaluable skills that I use daily in my work.

My advice

Take the opportunity to attend lectures in different disciplines. The theoretical studies in the classroom are best complemented with practical experience through internships and placements in companies. This is the best preparation for your professional career and an opportunity to gain important contacts.

Felix Brändli

Amstein + Walthert AG



My job

The small team I'm part of within Amstein + Walthert is in charge of developing new energy and water strategies for large building complexes or factories. For the ETH Hönggerberg we developed a concept which allows the future use of discharged oil tanks as water retention space in case of heavy rain. Another current project is advising a large retailer as to whether it is reasonable to install a decentralized wastewater treatment plant in their new, industrially sized bakery.

What I like about my job

The projects we are working on are very diverse and are in different phases. On one day we might inspect a construction site, while on the next day we brainstorm new concepts for how to supply an area with energy. Daily business is usually varied as well. Meetings, phone calls and sometimes even a field trip to the sewage system are welcome interruptions from work on the computer.

How my studies at ETH have benefited me

During university studies I was able to acquire basic skills in the fields of energy and water, which allow me today to solve the daily tasks on the job. However, the biggest benefit coming from all that studying is being able to become quickly and independently acquainted with new topics.

My advice

Try not to take your classes too seriously. Take some time to do sports, hang out with friends or go travelling.

Student life at ETH

There are many opportunities to enjoy an active student life at ETH Zurich. It is important to schedule your studies well so that you also have time for relaxing and socialising.



Students at work

Student organisations

Get involved in the Geomatics & Environmental Engineering (GUV) student union (www.guv.ethz.ch) and/or the ETH-wide (VSETH) student union (www.vseth.ethz.ch). As a member you can be engaged in decision-making at ETH that affects students and actively influence the organisation of study programmes. These student bodies also organize fun activities, like summer and winter camps, skiing and hiking trips, excursions, and various campus events.

Balancing your studies

The Academic Sports Association of Zurich (ASVZ), one of the largest sports associations in Europe, offers ETH Zurich students over 130 indoor and outdoor sports activities. Enrolled students can take part in most activities free of charge, or simply use the on-campus sports facilities in their



Student bar LochNess

own free time. At the Höggerberg campus, students have access to a modern sports hall with space for ball sports, fitness training, dance, sauna. There are jogging trails in the nearby forest. You can also join music groups, e.g. the academic orchestra, jazz band, etc. Remember to balance your studies with other activities to relax and enrich your learning experience.

Studying and living on campus

As a student of environmental engineering you will have access to study rooms at the ETH Höggerberg campus with work desks. Here you can work on your exercises, conduct your group work meetings, discuss with fellow students, and study for exams. The campus library is also a quiet place to read and learn. Student computer labs with desktops and printing facilities are also available for your use. Enrolled students have access to the ETH library with a rich collection of books and journals. Study materials will generally be provided for you online by the instructors. Required course textbooks and office supplies can be bought at the campus bookstore SAB.

The ETH Höggerberg campus provides a wide range of meal options throughout the day. There are three dining halls with discounted lunch menus for students, various street food stands, and several bistros and cafeterias for drinks and snacks that are open late. A student-run bar is open for evening get-togethers with fellow students. A small supermarket offers a basic selection of groceries and the local post office provides a full range of postal services. ATMs are available for cash withdrawal. You should find everything you need for daily life on the campus.

Affordable accommodation is a general problem in Zurich. Most incoming foreign students should look for accommodation in one of two new dormitories built on the Höggerberg campus. Here you will find modern single rooms with shared living and entertainment facilities, day-centers for small children, and other facilities. All of this is surrounded by green space, and only minutes away from classes. Most Swiss students live in shared apartments in the city called WGs, but these are difficult to rent from abroad by foreign students. There are however other student housing options in the city if you do not find a room on campus. Accommodation fills quickly, so start your search early. The accommodation contact point at ETH is www.wohnen.ethz.ch.



Sport Centre at Höggerberg Campus
© ETH Zurich / Alessandro Della Bella

Transportation at ETH

Most courses in the Master Programme in environmental engineering take place on the Höggerberg campus. Three public bus lines serve the campus, with a high frequency, from all directions in the city. In addition, the ETH Link bus line connects the ETH Zentrum and Höggerberg campuses with a direct service every 20 minutes. This is useful for quick transfer if you have classes on the other campus. Access to the university is easy and convenient and it will generally not disadvantage students who live off-campus.

Zurich

Zurich is the business center of Switzerland. With about 425 000 inhabitants it is the largest city in Switzerland. Located on the Zurich Lake and Limmat River it has a charming historical center and a modern European feel. With about 30 % foreign inhabitants, the city is very international and prides itself on its multicultural flair. With an outstanding public transportation system, ample green space and closeness to the mountains, many cultural activities and active night-life, Zurich is a truly attractive place to pursue your studies and call your temporary home.



Campus Hönggerberg at ETH Zurich
© ETH Zurich / Alessandro Della Bella



Limmat River in the centre of Zurich

ETH Zurich Facts und Figures 2017

Freedom and individual responsibility, entrepreneurial spirit and open-mindedness: ETH Zurich stands on a bedrock of true Swiss values. Our university for science and technology dates back to the year 1855, when the founders of modern-day Switzerland created it as a centre of innovation and knowledge.

At ETH Zurich, students discover an ideal environment for independent thinking, researchers a climate which inspires top performance. Situated in the heart of Europe, yet forging connections all over the world, ETH Zurich is pioneering effective solutions to the global challenges of today and tomorrow.

20,607
Students
(headcount)

4,100
doctoral students,
from over 120 countries
(headcount)

531
Professors
(headcount)

21
Nobel Prize winners,
including Albert Einstein
and Wolfgang Pauli
1 Fields Medal winner

9,436
Personnel
(full-time equivalents)

2 Pritzker Prize
winners

90
patent
applications

380
spin-offs since 1996

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