

# ETH ZÜRICH

## Energy Concept



**ETH**

Eidgenössische Technische Hochschule Zürich  
Swiss Federal Institute of Technology Zurich

# Preamble

ETH Zurich is a technical-scientific institute of research and education that enjoys an excellent international reputation. As such, it takes up important challenges that include energy, climate, and environmental issues. It is of utmost importance for ETH Zurich to carry out fundamental research at a high level that is internationally acknowledged, to elaborate practical approaches to solving them, and to ensure that this knowledge is broadly embedded in its teaching.

ETH Zurich provides a broad range of infrastructure for research and teaching. This is mainly located at its own buildings in the city center of Zurich and at the ETH Hönggerberg campus. An optimally functioning infrastructure requires a highly reliable energy supply. ETH Zurich's energy requirements are covered by a variety of energy sources including electricity, natural gas, district heating, and fuel.

ETH Zurich deals with the changing infrastructure requirements through long-term planning and, as far as possible, flexible adaptation. Growth and increasing demands on the energy services will require major investments in ETH Zurich's energy supply in the future. These investments must be energetically efficient, ecologically sustainable, and economical.

In addition to the direct use of energy for operating its own infrastructure, ETH Zurich and its affiliates also receive services that have, or necessitate, high energy usage. This indirect energy consumption is also important in a holistic assessment of energy use at ETH Zurich. Examples include the embodied energy of building materials or the use of energy for mobility.

With regard to the global challenge of ensuring a sustainable energy supply and prosperous national economies, the Executive Board has defined an energy concept for ETH Zurich that includes spheres of activity and concrete measures.

This energy concept is guided by insights gained from our own research as well as by political and societal framework conditions. Furthermore, the national and international perception of ETH Zurich as an exemplary institution of sustainable development should also be consistently recognizable in the energy concept.



# Guidelines

1. ETH Zurich conducts and fosters fundamental research for sustainable energy supply that meets the highest international standards.
2. ETH Zurich communicates state-of-the-art knowledge on energy-relevant issues to its students.
3. ETH Zurich has an active role to play as a model of efficient energy usage.
4. This energy concept is in line with the strategic development of ETH Zurich. The timeliness and implementation of the concept will be periodically reviewed and, if necessary, adapted by the Executive Board of ETH Zurich.
5. Conflicts of objective are taken into account, critically analyzed, and communicated transparently. Decisions should be broadly supported through consultation of an expert body convened for that purpose by the Executive Board. Examples of conflicts of objective at ETH Zurich include:
  - a. Growth and development vs. energy use
  - b. Global orientation of research and teaching vs. CO<sub>2</sub> emissions due to mobility
  - c. Technical feasibility vs. financial framework conditions
  - d. Requirements of research and teaching vs. measures to enhance energy efficiency
  - e. Use of funds to subsidize new technologies vs. use of funds for own research
6. Taking into account the conflicts of objective mentioned above, energy is used as efficiently as possible at ETH Zurich.
7. If the required energy services permit, lower-value forms of energy (e.g., waste heat) should always be preferred to higher-value forms (e.g., electricity).
8. ETH Zurich defines paths for the reduction of its own final energy use, of the use of non-renewable energy, and of its CO<sub>2</sub> emissions. These reduction paths include target values for 2020 and 2035.
9. The Executive Board systematically requests and integrates the specific knowledge of ETH Zurich's own researchers in decisions of long-term and significant impact.
10. In the field of energy, ETH Zurich actively seeks to exchange information with other universities and the private sector in order to achieve continuous improvement by implementing examples of best practices.
11. The energy concept has concrete effects in the following areas of activity:
  - a. Research
  - b. Education
  - c. Raising awareness among ETH Zurich staff
  - d. Construction and refurbishment of buildings
  - e. Operation of infrastructure
  - f. Mobility
  - g. Reporting and communication
12. The measures are systematically collected, assessed, and reports on their implementation submitted annually to the Executive Board.

# Concrete Areas of Activity for ETH Zurich's Energy Concept

## Research

Energy research at ETH Zurich has a long tradition, and is shaped by more than 40 professorships with over 200 PhD students in various centers of competence. Since 2005, the Energy Science Center (ESC) has promoted cross-departmental cooperation at ETH Zurich and identified synergies between various research disciplines.

- ETH Zurich supports fundamental research in the field of energy. Adopting a long-term energy perspective requires concrete strategies for resolving problems as well as long-term technological and societal options in equal measure.
- The increasing interdisciplinarity of energy research is taken into account. In doing so, the Energy Science Center (ESC) has a key coordination role for energy research activities at ETH Zurich.
- ETH Zurich is specifically expanding its research competence in the areas of sustainable and renewable energy, as well as in the energetic refurbishment of old and historic buildings.

## Education

On the topic of energy, ETH Zurich offers a comprehensive catalog of lectures. The courses on offer span the entire range of training levels with various degrees of specialization and topical emphasis. Since 2007, ETH Zurich has been offering its own Master in Energy Science and Technology course.

- ETH Zurich supports student research projects on energy topics at its own institutes or in cooperation with government agencies and the private sector. These projects are collected in a database and published in an easily retrievable format.
- ETH Zurich increasingly emphasizes matters of sustainable energy supply in an interdisciplinary approach – where possible, already in the basic and graduate courses. The credit points awarded for such courses should be recognized in as many degree programs as possible.
- At ETH Zurich, critical discussion of energy-relevant issues such as sustainable energy supply, cost-effectiveness, cleantech, or efficiency should be encouraged in lectures at all levels of training.

## Raising awareness among ETH Zurich staff

Since 2004, the environmental management conducted by the Real Estate infrastructure division has been certified ISO 14001 and complies with clearly defined environmental goals. Since 2008, ETH Zurich has officially participated in the RUMBA (Ressourcen- und Umweltmanagement der Bundesverwaltung) program. Each department and many of the infrastructure divisions are directly represented in the RUMBA Commission with environmental delegates.

- ETH Zurich staff are motivated to engage in environmentally friendly behavior through awareness-raising and incentives.
- The departments of ETH Zurich are involved in the efforts to enhance energy efficiency at ETH Zurich through incentive systems that aim to create a balance between individual responsibility and guidelines.

## Construction and refurbishment of buildings

In the construction and refurbishment of buildings, ETH Zurich has been aiming to achieve energy efficiency for some time now. Target values for energy efficiency are set that are equivalent to or even exceed the performance indicators required by established energy labels. These efforts are complemented by the construction and expansion of the internationally acclaimed innovative energy supply grid (Anergy Grid) at Höggerberg – a flagship project that has gained nationwide attention.

- ETH Zurich aims to achieve a rapid reduction of CO<sub>2</sub> emissions and an increasing share of renewables in the energy usage of its infrastructure. ETH Zurich achieves this through specific requirements concerning the energy technology used in its refurbishment concepts and standards for new buildings.
- In its tenders and subsequent awarding of architecture competitions, ETH Zurich attributes great importance to sustainability criteria in general and energy efficiency in particular. Consideration of the total life cycle is an integral part of this.
- In major investment projects, ETH Zurich assesses costs, energy usage, and emissions over the entire life cycle of the investment. In newly constructed buildings, only state-of-the-art construction standards and energy-efficient construction types are used.
- On its campus, ETH Zurich promotes flagship and pilot projects focused on energy (efficiency), subject to comprehensive risk analysis.
- Complex refurbishments in the area of energetic optimization of ETH buildings (e.g., buildings under heritage protection) are supported and attended by ETH experts. Researchers are called upon to find new solutions for conflicts of objective.

## Operation of infrastructure

At ETH Zurich, optimization of infrastructure operations in terms of energy efficiency has been ongoing for years and is becoming more and more important. For instance, the specific energy use normalized per m<sup>2</sup> of floor area (electricity and heating) has been continuously lowered from 260 kWh/m<sup>2</sup> in 2007 to around 234 kWh/m<sup>2</sup> (2011). The requirements of the target agreement reached with EnAW (Energieagentur der Schweizer Wirtschaft) have also been successfully met every year since 2007.

- Security of energy supply is crucial and a top priority for ETH Zurich.
- ETH Zurich supports the production of renewable energy. The mix of energy sources for the electricity used at ETH Zurich is entered into a balance sheet for annual bookkeeping and is offset by purchasing guarantees of origin (GOs).
- From 2013 onwards, the share of power from renewable sources at ETH Zurich will be at least equal to or greater than its share in the total mix of electricity in Switzerland (production mix). The share of power from renewable sources<sup>1</sup> will be continuously increased. The target is 100% by 2035.
- For operation of the new energy supply system at Hönggerberg (Aenergy Grid) specifically, ETH Zurich will only use power consisting of a mix of energy sources that complies with high ecological standards.
- ETH Zurich's internal guidelines and standards for energy efficiency are given strong consideration in purchasing building and climate technology.
- A systematic and continuous optimization of operations is carried out for the main energy consumers (building technology, IT infrastructure, and other large devices).
- ETH Zurich has energy efficiency guidelines for purchasing standard devices (e.g., refrigerators, computers, printers, etc.).
- In the planning of larger-scale research facilities, an energy check is conducted in advance that takes energy-efficient alternative solutions into consideration.

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<sup>1</sup> The share of power from renewable sources always refers to the calculated mix of energy sources as consolidated for ETH Zurich, including offsets from any additionally purchased GOs.

## Mobility

ETH Zurich is in a constant dialog with the City of Zurich concerning the further development of its campuses. The introduction of the ETH Science City Links (dedicated bus connection) has connected the two ETH Zurich locations by public transport and integrated them even better into the existing public transport network of the City of Zurich. Since 2007, ETH Zurich – as one of the first universities – has also included the emissions calculated for mobility behavior in its CO<sub>2</sub> balance sheet.

- ETH Zurich provides alternative ways of ensuring international networking (e.g., videoconferencing) and actively promotes their use.
- Air travel is used sparingly at ETH Zurich. Data on frequency of air travel is provided to the departments as a means of awareness-raising.
- Wherever possible, use of trains is given preference to travel by airplane and car.
- Together with the cities in question, ETH Zurich encourages commuters to ETH Zurich and between the ETH campuses to strive for environmentally responsible mobility by fostering use of public transport and non-motorized traffic (bicycle, pedestrian).

## Reporting and communication

Since 2003, ETH Zurich has been systematically collecting its energy operating figures and communicates these transparently both internally and externally. What was initially the ETH Zurich energy report became, in 2005, the ETH Zurich environmental report. Since 2010, as one of the first universities, ETH Zurich has published a certified GRI (Global Reporting Initiative) Sustainability Report.

- In all energy-relevant areas, an energy controlling is carried out that is level-appropriate and cost-efficient. The main energy operating figures are communicated annually internally and externally.
- The individual units (departments, core services, etc.) receive energy-relevant data on an annual basis as a way of raising awareness.
- The main energy parameters are listed not only in absolute figures, but also specifically (e.g., per FTE or m<sup>2</sup>).

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## Imprint

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**Pictures:** Energy channel connecting buildings on Campus Hönggerberg (title page; ETH Zurich)

Supercomputer Aquasar is cooled by hot water. Through a heat exchanger, the heat dissipated by the processors is used directly for heating buildings (preamble bottom left; Josef Kuster/ETH Zurich)

As part of the focus projects in 2011, students present their "SunCar", which runs on solar energy (preamble bottom right; Tom Kawara/ETH Zurich)

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The energy concept is available in English and German.

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