Promoting biodiversity

The institutions of the ETH Domain not only operate an infrastructure with installations of the highest technical standards, they express a sense of responsibility in ensuring the minimum stress on the environment and careful handling of resources. They are also the owners of large open spaces, which they efficiently manage according to the principles of natural and sustainable care, thus contributing to the biodiversity of Switzerland.

"The upgrading of the ecosystems, with the strengthening of support for the ecosystem services that this entails, is a task for all levels of government and the civil populace, for all sectors and the whole population. [...] From 1985 to 2009 land use in Switzerland changed completely for 15 % of the ground area – unfortunately most often to the detriment of biodiversity." This is a quotation from "State of Biodiversity in Switzerland 2014 – Scientific Analysis", a report which researchers from several institutions of the ETH Domain contributed to. Besides the academic contributions to biodiversity, in 2015 the institutions of the ETH Domain also achieved visible results in applied biodiversity, for example by measures to protect the yellow-bellied toad, an amphibian just 50 mm in size that is threatened by extinction; or by the natural enclosure and environmental design of the large research facility SwissFEL, over 700 m in length, in the Würenlinger forest.

The estates of ETH Zurich Hönggerberg, of EPFL in Ecublens, of the WSL in Birmensdorf, of the Empa and Eawag in Dübendorf, St. Gallen and Kastanienbaum, and of the PSI in Villigen, are all cultivated in a nature-friendly way. For example, at EPFL the 55 hectare campus is managed according to the principles of full utilisation, with native plants, planted roofs and permeable surfaces – even on parking spaces. For many years now, EPFL, WSL, PSI and Empa have been awarded the quality label of the Nature & Business foundation for their services in this area, and are committed to taking appropriate care of the land.

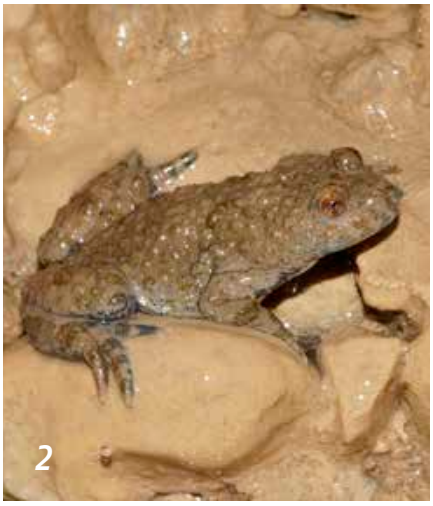
The promotion of biodiversity starts on a small scale, with simple nesting boxes for various species of birds and bats, little "hotels" for bumblebees and other wild bees, and the maintenance of fallow land and small-scale structures (heaps of branches, stones or grass, hedges etc.), as practised by ETH Zurich, WSL, PSI and Eawag. Roof planting is also a standard practice in the ETH Domain. For example, at the PSI over 13,500 m^2 of roof area have been planted with greenery.

The kind of effect that small-scale, effectively applied measures can have, is shown by one example from ETH Zurich. When mowing its hayfields, strips are left standing for insects to return to; and the flower heads are only cut in spring so that birds and insects can also have a variety of food in winter. It also promotes the local biodiversity by providing nesting structures for various species of wild bees, in wild bee gardens planted with native wild shrubs. Even slow-worms and amphibians live on the estates of ETH Zurich.

The WSL maintains a 10 hectare estate in Birmensdorf with experimental gardens and two wetland biotopes, extensively managed meadows, and a reopened stream. The stream was also widened by adding little bays in 2014, which serve as habitat for the yellow-bellied toad, "Amphibian of the year" for 2014, which is an endangered species. The PSI also installed wetland biotopes, to support the Canton of Aargau's measures to protect amphibians.

One major project in the field of promoting biodiversity was the revitalisation of the Chriesbach stream in Dübendorf, which was completed in 2015. The inspiration for this came from Eawag, who then carried out the project with the municipality and with the Canton as project leader. Suitable native wild plants, some of them endangered, were chosen for planting along the Chriesbach stream, in cooperation with the Business and Ecology Foundation (SWO). The Canton and Eawag also instructed the SWO to constantly combat invasive neophytes (plant species that are foreign to the region). As part of the revitalisation of the Chriesbach stream, an open-air laboratory with great structural diversity was built on the Eawag estate; this is accessible to the public and with its display panels and outdoor aquarium it provides a close view of the native flora and fauna. An initial social science study by Eawag, WSL and the University of Zurich showed that the revitalisation of the Chriesbach not only benefits nature but the people as well. The EPFL is working in this direction, too, and in October 2015 it installed an instructive fitness trail on its estate. Ten illustrated display panels which have been put up on the estate, help the visitors to discover the impressive biotopes that have gradually been created on the estate.

The Würenlinger forest is a habitat for numerous plant and animal species, as well as being a place of relaxation for the local people who live and work in the area. Here the 740 metre long X-ray free electron laser SwissFEL of the PSI is to be commissioned in 2016. This facility is built on two floors and is about 10 metres in width, with several annexes for the machines and the experimentation hall. To do justice to the sensitive location, in a two-year project an interdisciplinary team of experts created a plan to embed the SwissFEL within its surroundings in the best possible



1 Revitalised Chriesbach stream in Dübendorf. *(Image: Andri Bryner / Eawag)*

2 Endangered species: the yellow-bellied toad. *(Image: Thomas Reich / WSL)*

way. Most of the installation was covered over by soil. A wild pasture will then be planted on top of this layer of earth, as a habitat for many species of insects, butterflies and wild bees. Ponds and areas of open ground, shrubs and hedges, will all join to become a biotope favourable for the very sensitive species of amphibians. The endangered grey long-eared bat, which is found locally, will find a new source of food in the forest glades around the SwissFEL. Two deer corridors allow the undisturbed passage of wild animals across the facility, and the traffic to the installation will be kept to a minimum.

Environment and energy in the ETH Domain

The ETH Domain provides a detailed report of its commitment to the field "Environment and Energy" in two publications issued by the Federal Government. The "Annual Report – the Confederation as a model example for energy" (EVB, in German), of the Swiss Federal Office for Energy (SFOE)[45]; and the report "Management of Resources and the Environment by the Federal Government" (RUMBA, in German) of the Federal Department of the Environment, Transport, Energy and Communications (DETEC)[46]. The implementation of the measures under the EVB is set to run until 2020 and is well on course. For the RUMBA programme the ETH Domain issues reports every two years. The detailed reporting in the Annual Report of the ETH Board (see fig. 44, p. 145) presents and complements that of RUMBA because it is based the same parameters. The institutions are responsible for implementing the environmental and energy management in the ETH Domain, focussing on its operational aspects. Once again, several notable projects and measures of the institutions have been initiated or realised in this field in the year under review 2015.

ETH Zurich was engaged in applying many environmental measures in 2015. It endeavours to secure certification from the Swiss Association for Sustainable Real Estate Management (SGNI) for its new building projects and major renovations. Two laboratory buildings have already received the SBNI "Gold" pre-certificate. In this way the buildings are planned and constructed on the basis of

[45] Published in July 2015 by the Swiss Federal Office for Energie (SFOE).
[46] Published in September 2015 by Federal Department of the Environment, Transport, Energy and Communications (DETEC).

sustainable principles. In 2015 the expansion of the Hönggerberg energy network was continued, with a head office being built for the new residential buildings for students. The new energy concept also includes a "cooling ring" in the ETH centre, and a possible connection for utilising the lake water of Zurich lake. In 2014 the electricity requirements of ETH Zurich rose by 8 GWh over the previous year, to 140 GWh (+ 6.4 %); and the heating by fossil fuels was reduced from 37.9 GWh (2013) to 36.5 GWh (2014, – 3.8 %). ETH Zurich was able to reduce the direct CO_2 emissions in this way.

When it comes to vehicle procurement, again ETH Zurich acts in a sustainable way: it follows an integral approach, with a systematic evaluation procedure. In IT, significant energy savings were made by using new storage technologies. The new storage media hold larger volumes of data while using less energy. This leads to energy savings in normal operation of about one third of the amount previously consumed. Indeed, the long-term storage of data is 50 times more energy efficient. Finally, the new operational efficiency manager started work in 2015. This appointment testifies to ETH Zurich's intention to run its installations in an even more energy-efficient way.

www.umwelt.ethz.ch

The year 2015 was marked by the opening of the solar park Romande Energie-EPFL, the biggest Swiss solar energy plant installed on an existing building complex. It took five years to build. The system with an installed capacity of 2.1 MW extends across 25 buildings and uses various state-of-the-art photovoltaic systems. An energy structure plan for EPFL was decided in keeping with the objectives of the Federal Government's Energy Strategy 2050.

By maintenance work on the central heating system of the ELG building, and adjusting the ventilation settings, it was possible to reduce the heat consumption in this building by more than 50 %. This corresponds to thermal energy savings of over 400,000 kWh/year. At the Rolex Learning Center a reduction in energy consumption of 12 % was achieved by an adjustment of the ventilation systems in the building.

exploitation-energies.epfl.ch

The PSI develops, builds and operates internationally competitive, large-scale research installations, and makes them available to the national and international research community. Special consideration is given to the aspect of energy efficiency during the planning, construction, operation and renovation of these installations. For a long time now the PSI has made use of a part of the waste heat from the research installations, for the heating. To implement this strategy consistently and utilise the full potential, a heat reclamation system for the whole estate was designed. This installation was nearing completion in 2015. After SwissFEL starts operating, this measure will allow some 75 % of the entire heating needs of the PSI to be covered by waste heat from the research installations. Besides this method, operational improvements are continually being made to the infrastructure at the PSI, especially for the systems that consume the most energy (large machines, building services, IT infrastructure). This leads to an increased energy efficiency in the long term, without curtailing the performance or availability of the large-scale research facilities for the community of users.

www.psi.ch/about/psi-energy-concept

In 2015 the WSL was actively involved in upgrading the energy supply systems. In Davos the last of the buildings was upgraded to the Minergie standard. In Birmensdorf, one of the two buildings from the 1950s was renovated to the Minergie-P-Eco standard, and work on the second one will be finished in 2016. For this, prefabricated insulated façade elements will be applied to the existing façade, thereby reducing the heating requirements of these two buildings by 85 %. Their oil-fired heating was decommissioned and the buildings were connected up to the existing wood chip heater. This allows the WSL site Birmensdorf to be heated CO_2-free, starting from the heating period 2015/2016. What is more, the completed building was fitted with a solar roof (305 m^2) providing an estimated annual production of 50,000 kWh.

www.wsl.ch/umweltmanagement

At Empa the extensive planning for a conversion and extension of the site in Dübendorf was the main topic in 2015. By reducing the heating system temperatures, the aim is to use most of the waste heat that had previously been unusable, for heating purposes. The building conversion works that have been done so far have led to a significant reduction in energy consumption thanks to the improved insulation. At the St. Gallen site, following a comprehensive energy supply analysis, the implementation of the measures indicated was started in 2015. The largest project involved the replacement of two large cooling machines by a combined heat pump / cooling machine. Thanks to the considerable increase in energy efficiency it is now possible to save on 228 tons of CO_2 per year. In a second project, the existing photovoltaic system rated at 50 kWp will be expanded to 75 kWp. In this way self-production will be increased from 1 % to 2.5 % of the electricity requirement.

www.empa.ch/web/empa/resources-environment

At the end of 2015, at the Dübendorf site Eawag increased its own photovoltaic production on the Forum Chriesbach building from 70 MWh to 100 MWh per annum. A novel design of substructure for the panels improves the conditions for the planted roof by providing ideal ventilation at the rear, leading to greater biodiversity on the roof. For both sites in Dübendorf and Kastanienbaum, new contracts with the "naturemade star" certificate have been running since 2015 following a bid for tenders, now held for the third time. In this way Eawag covers its entire electricity requirements from renewable energy. For 97.5 % it buys "naturemade star" certificates for hydroelectric power. The ecological criteria for a certification to "naturemade star" for hydroelectric power are based on research by Eawag. The remaining 2.5 % are certificates for new renewable energy, mainly photovoltaic.

www.umwelt.eawag.ch

Fig. 44: Environment and energy data

		ETH Domain 2013	ETH Domain 2014	ETH Zurich Total	EPFL Total	PSI Total	WSL Total	Empa Total	Eawag Total	ETH Domain Trend 2015[1]
Basic data										
Energy reference area ERA[2]	m^2	1,370,483	1,416,238	688,316	403,668	147,049	28,965	120,641	27,599	1,481,978
Full-time equivalent[3]	FTE	32,517	33,030	18,391	10,562	1,944	604	932	597	34,827
Energy[4]										
Final energy net[7]	**kWh / a**	**433,023,327**	**424,363,562**	**175,016,644**	**91,901,108**	**133,263,119**	**4,575,265**	**15,066,326**	**4,541,100**	**442,732,564**
Electricity net (not incl. self-produced)	**kWh / a**	**353,683,736**	**360,356,537**	**140,283,000**	**77,755,385**	**125,497,653**	**2,930,203**	**10,703,536**	**3,186,760**	**373,339,388**
Consumption of uncertified electricity	kWh / a	234,656,595	73,477,017	12,874,440	0	47,160,364	69,418	13,061,045	311,750	–
Sale of uncertified electricity	kWh / a	– 6,340,091	– 5,804,241	0	– 3,446,732	0	0	– 2,357,509	0	–
Consumption of certified electricity	kWh / a	125,367,232	292,683,761	127,408,560	81,202,117	78,337,289	2,860,785	0	2,875,010	–
– Electricity (wihtout naturemade star)	kWh / a	113,025,365	278,775,510	123,408,560	74,311,915	78,337,289	2,717,746	0	0	–
– Photovoltaic naturemade star	kWh / a	710,945	2,159,919	0	2,000,000	0	143,039	0	16,880	–
– Hydro power naturemade star	kWh / a	11,575,922	11,693,332	4,000,000	4,890,202	0	0	0	2,803,130	–
– Wind naturemade star	kWh / a	55,000	55,000	0	0	0	0	0	55,000	–
Heat	**kWh / a**	**76,953,366**	**60,903,802**	**33,544,644**	**13,863,723**	**7,442,466**	**1,147,839**	**3,712,790**	**1,192,340**	**–**
Fuel oil	kWh / a	8,886,214	2,268,480	20,000	1,692,025	349,520	206,235	0	700	–
Natural gas	kWh / a	61,177,379	53,021,591	36,452,000	12,030,171	0	0	4,522,040	17,380	–
Natural gas BHKW	kWh / a	25,954	0	0	0	0	0	0	0	–
District heating	kWh / a	35,505,557	28,796,711	19,802,000	362,505	7,092,946	0	365,000	1,174,260	–
Wood chip	kWh / a	2,136,538	1,162,248	220,644	0	0	941,604	0	0	–
Sale of heat	kWh / a	– 30,778,275	– 24,345,228	– 22,950,000	– 220,978	0	0	– 1,174,250	0	–
Fuels (own vehicles)	**kWh / a**	**2,386,225**	**2,941,223**	**1,189,000**	**282,000**	**323,000**	**497,223**	**650,000**	**162,000**	**–**
Energy: additional information										
Energy costs electricity and heat[5]	CHF / a	48,178,165	45,620,448	20,582,357	10,577,000	11,559,577	527,660	1,794,938	578,916	49,397,099
Self-generated renewable electricity	kWh / a	428,327	450,788	254,000	0	0	28,000	25,318	143,470	–
Total sale to third parties	kWh / a	– 37,118,366	– 30,149,469	– 22,950,000	– 36,67,710	0	0	– 3531759	0	–
Water (drinking water)	**m^3**	**602,901**	**618,123**	**291,791**	**170,585**	**122,378**	**9,313**	**19,820**	**4,236**	**630,749**
Materials										
Paper	kg	416,400	393,591	209,658	116,120	36,753	11,777	12,375	6,908	401,584
Paper new fibre	kg	215,900	213,173	108,813	76,254	11,605	3,925	12,375	201	136,908
Paper recycled	kg	200,500	180,418	100,845	39,866	25,148	7,852	0	6,707	264,676
Key figures: environmental impact										
Primary energy[6]	GJ / a	3,532,812	2,755,590	812,529	382,112	1,365,506	37,660	134,382	23,402	–
Proportion of renewable energies	%	14.9	31.5	56.3	11.1	14.7	23.3	12.8	54.8	–
CO_2 emissions	t CO_2 / a	65,343	57,986	15,089	15,360	21,678	683	4,646	529	–

[1] Provisional figures for year under review (trend) as at beginning of March 2016.
[2] The energy reference area is the sum of all gross floor areas, above and below ground, which must be heated or airconditioned in order to be used.
[3] The FTE (full-time equivalent) value listed here was supplemented by the number of students with an FTE value of 0.68 to derive the consumption per person.
[4] The key indicator "energy consumption" shows the total consumption of heat and electricity for buildings as well as for teaching and research activities.
[5] The key indicator "energy costs" shows all expenditure (cash out) for the provision of energy (heat and electricity).
[6] In energy economics one refers to primary energy as the energy that is available using the originally occurring forms or resources of energy, such as fuel (e. g. coal or natural gas), and indeed also energy carriers such as sun, wind or nuclear fuels.
[7] Final energy is the portion of the primary energy that is left after losses due to energy conversion and transmission, after it is supplied via the consumer's domestic connection. The final energy basically corresponds to the energy that is purchased.