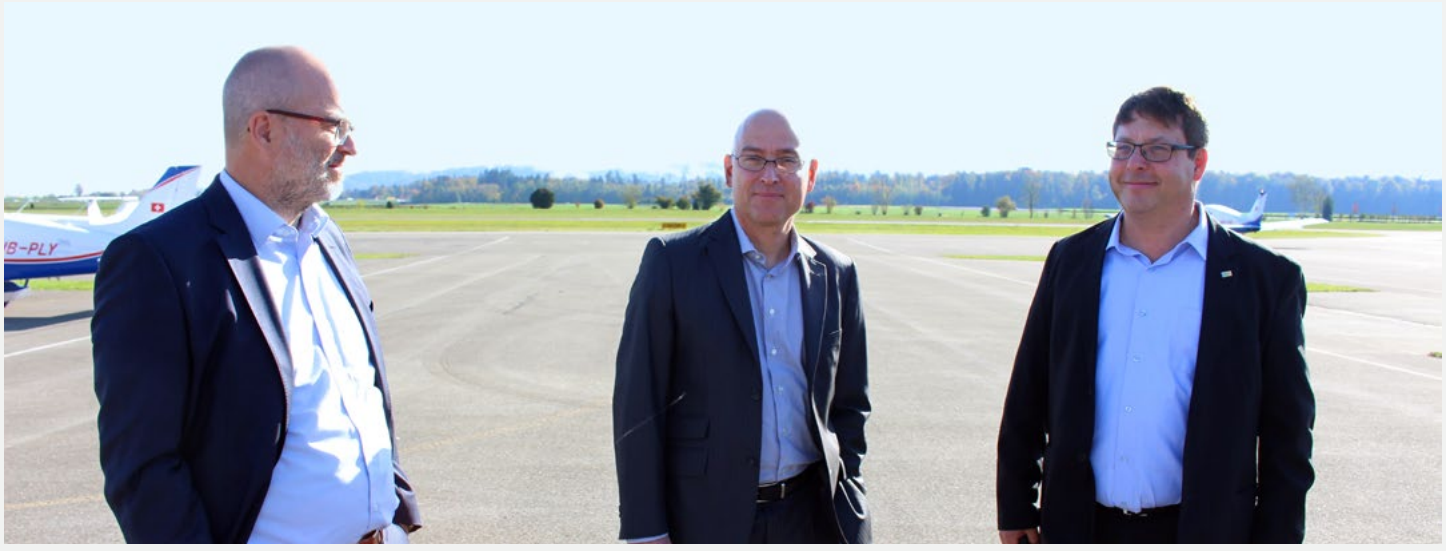
GRIDEYE: AUTOPILOT IN THE SMART GRID

ENERGY TECHNOLOGIES CATEGORY. Smartgrid or microgrid are terms which are difficult for laypeople to understand. However, they are in everyday use at distribution network operators and for good reason because these types of technology are a necessary requirement if we are to be able to use renewable forms of energy in the future. DEPsys SA at Puidoux in the Canton of Vaud has brought the smart-grid platform "GridEye" to the point where it is ready for the market. The platform helps grid operators cope with the demanding task of integrating renewable, decentrally produced and fluctuating amounts of energy into the grid. GridEye monitors, stabilises and optimises the grid. The plug and play GridEye box can be simply attached to the existing infrastructure. On the basis of exact measurements the intelligent software learns about the actual condition of the grid. It derives information on the current situation in the grid and then optimally and efficiently controls the flows of energy between decentral power plants, battery storage facilities and consumers.

The distribution networks were established when electricity was only centrally generated. They are not designed to cope with a large number of decentralised feed-in points, such as hundreds of photovoltaic arrays, or to cope with the high loads that arise when many electric-powered vehicles are charging simultaneously. Such problems could be solved by expanding the grid, but this is a costly solution. A technological solution which leads to actively controlling the distribution network is more cost-effective and this is where DEPsys SA and GridEye come in. The architecture of the GridEye system, which is distributed throughout the grid, is entirely decentralised and can be extended at will. Single modules process the measuring data gathered locally and independently and then this data is exchanged among the modules. The units calculate in real time what the actual impact of feed-in and feed-out is on the grid and immediately trigger off the necessary control measures thus avoiding overload and voltage fluctuations in the grid.



F.l.t.r.: Ulrich Münch (DEPsys), Marc Schreiber (DEPsys) and Philippe Ramuz (IBB Energie AG)

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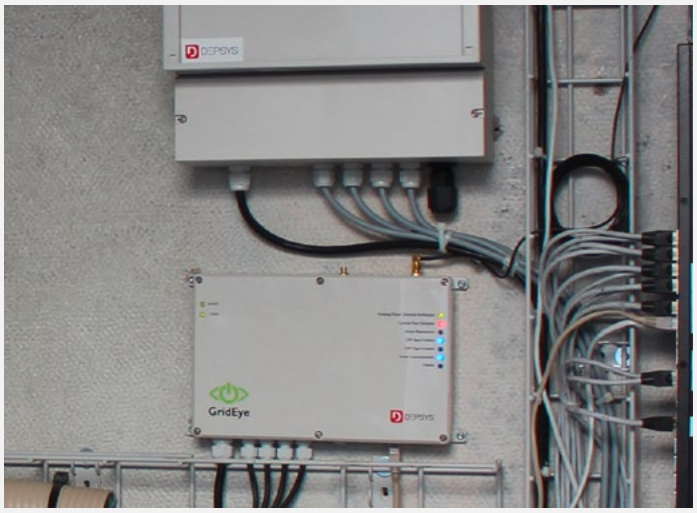
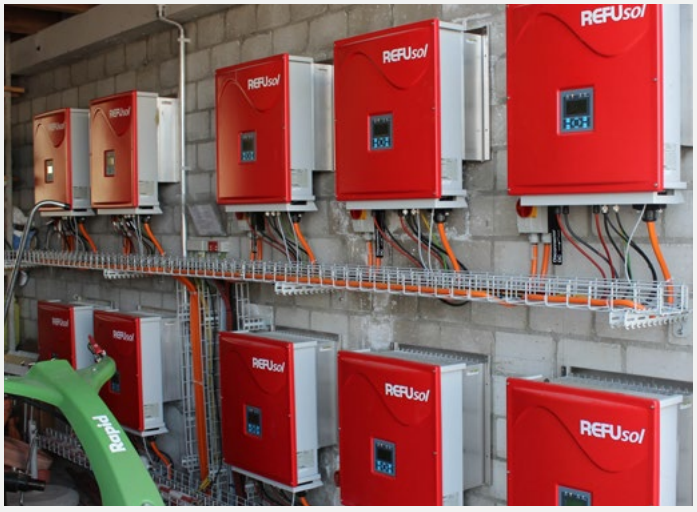
DEPSYS SA, 1070 Puidoux
↗ **WWW.DEPSYS.CH**

IBB ENERGIE AG, 5200 Brugg
↗ **WWW.IBBRUGG.CH**

GridEye was installed on behalf of IBB Energie AG at Birrfeld airfield. In partnership with IBB, Aargau Aero Club maintains a large 200 kW photovoltaic array on the roof of a hangar. On sunny days the airfield transformer has to work to the limit which means not all of the locally produced solar electricity can be fed into the grid. Two GridEye modules were installed to solve this problem. One measures the transformer current and the other measures the current at the hangar and steers the ten inverters. Use of the GridEye algorithm means the maximum power produced by the photovoltaic array can now be fed into the grid without endangering its stability. IBB now wants to equip other locations in the grid with this technology.



The motto of DEPsys SA, a start-up founded by the School of Management and Engineering Vaud at Yverdon-les Bains (HEIG-VD), is "Rethink energy". The company is doing well in Switzerland as well as in international markets.



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SUSPENDED SOLAR POWER PLANTS: CABLE CAR TECHNOLOGY FACILITATES DOUBLE USE OF INFRASTRUCTURE AREAS

RENEWABLE ENERGY CATEGORY. Infrastructure of various types is important for modern living but takes up a lot of space. To be able to use infrastructure for multiple functions requires four dimensional thinking which includes the values space and time. This is just the approach taken by dhp technology AG from Zizers in the Canton of Grisons. This start-up, which was founded in 2015, has developed the "HORIZON" foldable, lightweight solar plant in cooperation with local engineering partners. The development was supported by the Swiss Federal Office of Energy and by the Stiftung für Innovation, Entwicklung und Forschung Graubünden (foundation for innovation, development and research Grisons).

Using cable car technology HORIZON is suspended five metres above the infrastructure area in question and folds up like a concertina. If the sun shines, the non-reflective glass solar modules fold out and during windy weather or snowfall they automatically retract into the parked position. All this is taken care of by a specifically developed meteorological algorithm that controls the movement based on exact weather data. That means no sunny hours are lost in winter because solar modules are covered in snow and servicing and cleaning of the modules can be done easily and simply from the edge of the roof thanks to the foldability of the construction.

The first major plant of this type was realised for IBC Energie Wasser Chur and installed over the sedimentation tank of Chur sewage treatment plant where it was successfully put into operation in August 2018. It will produce about 540'000 kilowatt-hours of electricity every year that will be used entirely by the sewage treatment plant thus covering up to 20% of the electricity required. The advantages of HORIZON are that work under the roof is not restricted in any way because of the large distance between the supports (17x25 metres) and the height at which the module is hung (five metres) leaving the sedimentation tank free and accessible at all times. The

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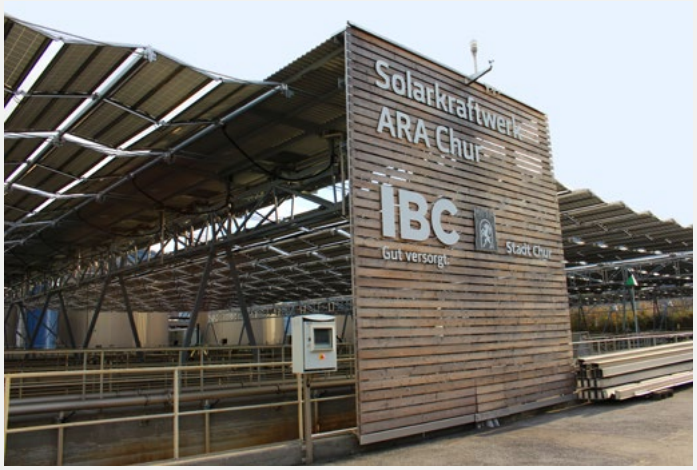
DHP TECHNOLOGY, 7205 Zizers
↗ **WWW.DHP-TECHNOLOGY.CH**

shade provided in summer not only benefits treatment plant employees it also inhibits the growth of algae in the tank reducing the amount of maintenance required. Compared to conventional fixed installations, which are exposed to storms, hail and snow, 50% less construction material is used in HORIZON, which is a further contribution to the economic feasibility of the system, and it can be dismantled easily when needed and installed at another location. The plant at Chur sewage treatment plant cost 1,65 million francs in total. No feed-in remuneration will be claimed.

dhp technology AG, whose motto is "Energy for Mankind", has contracts to equip four other sewage plants and a car park with the HORIZON system. In any case there is substantial potential for the system in Switzerland with its 800 sewage treatment plants and 64 square kilometres of car parks.

Andreas Hügli and Gian Andri Diem



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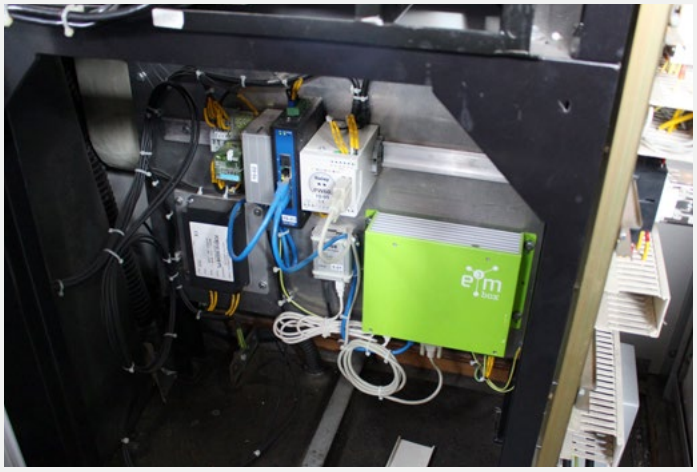
STEP BY STEP TOWARD GREATER ENERGY EFFICIENCY

ENERGY-EFFICIENT MOBILITY CATEGORY. The public transport sector has always reflected the spirit of the time. In recent decades travellers have tended to demand greater comfort when underway, while today they expect transport companies to use energy efficiently. If we want to save energy, we first have to have detailed measurements of consumption. When retired physicist Prof. Dr. Peter Oelhafen came up with the idea of such a measurement campaign in railway vehicles and rolling stock, he was welcomed with open arms by BLS AG. One of BLS railway's 36 NINA trains (NIederflur-HAhverkehrs-Zug/Low-floor suburban train) was equipped with sensors and electricity meters to measure the energy consumption of all parts of the train system. The results showed: only a little more than half of all the energy consumed by a NINA train was used to provide traction power, that is to pull the train. One third was used for heating, ventilation and air conditioning. Another astonishing fact discovered was that a NINA composition used 30% of the entire energy consumed in a year while parked because many systems continued to run in the usual, energy-intensive mode.

The substantial energy consumption from parked compositions was rapidly corrected by the introduction of a sleep mode. However, BLS was not finished yet. In the current 2015 to 2019 NINA modernisation programme, which includes improvements in comfort for passengers and in design, attention is being given to bringing the energy technologies up to the latest standard. For example fresh air feed to the passenger compartment is regulated as required by CO_2 sensors. As a first for Switzerland neon tubes have been replaced by LCC (laser crystal ceramics) lighting technology. This type of illumination consumes 10% to 30% less energy than an LED lighting system. Finally, new glazing was installed that not only substantially improved the insulation but was permeable to mobile radio waves thus providing for better reception on cell phones. This innovation was developed by ETH Lausanne in cooperation with partners from Swiss industry. These effi-



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UNIVERSITY OF BASEL, 4056 Basel
↗ **WWW.PHYSIK.UNIBAS.CH**

BLS AG, 3001 Bern
↗ **WWW.BLS.CH/EN/UNTERNEHMEN/PROJEKTE-UND-HINTERGRUENDE/ROLLMATERIAL/REFIT-NINA**

ciency measures reduced NINA compositions energy consumption by 20%. Together with the energy economy measures that have been implemented throughout the rest of the BLS fleet, an annual reduction in energy consumption has been realised of 13 million kilowatt-hours, equivalent to the annual consumption of over 3000 households.

The idea first floated by Prof. Dr. Peter Oelhafen has since led to a series of further projects on the topic of "Energy efficiency of heating, ventilation and climatisation in public transport", which are supported by swiss electric research and the the federal offices of transport and energy. In addition to BLS AG, SBB, RhB, SOB and tl Transports publics de la Région Lausannoise are participating in such projects. Research institutions involved include the Department of Physics of the University of Basel, the Institute for Building Technology and Energy at the University of Lucerne, Empa, ETH Lausanne, Bern University of Applied Sciences and SUPSI. In future work the focus will be not only on improving the energy efficiency of existing railway trains but also that of new ones. The incentive to save energy in operation is the Federal Council's decision of September 2018: from 2020 onwards the cost of electricity consumed by trains will have to be charged for according to the actual amount consumed and not as a lump sum.

Christoph Isenschmid (BLS) and Peter Oelhafen

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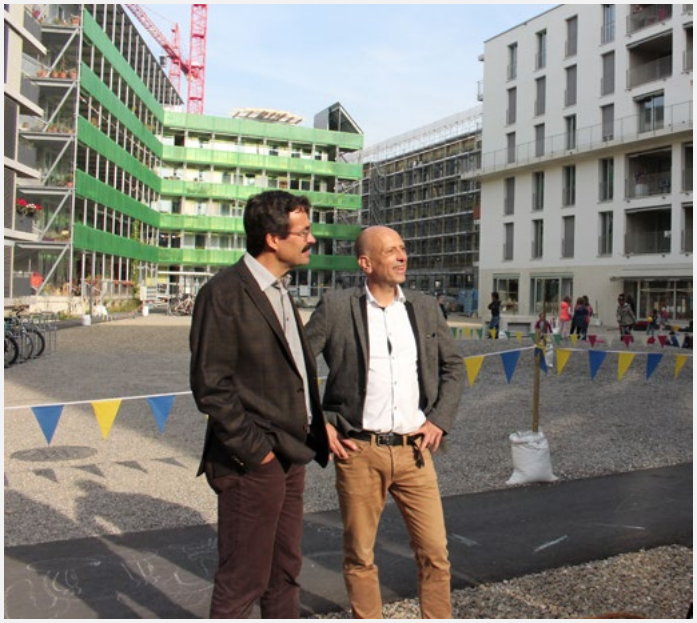
ERLENMATT OST: A SUSTAINABLE, COLOURFUL AREA WITH LOCAL ENERGY PRODUCTION AND SUPPLY

BUILDINGS AND SPATIAL DEVELOPMENT CATEGORY.
On the space that was once the Deutsche Bahn goods station in Basel the Stiftung Habitat (Habitat Foundation) has developed the new city district called Erlenmatt Ost. People moved into the first buildings in 2017; by mid-2019 the initial construction phase will be concluded and about 500 occupants will live in the area in more than 200 apartments. It is now clear that the foundation's plan to divide the space into 13 building plots is going to be successful because most of the plots have been snapped up in leasehold. The area is lively, colourful and sustainable designed in keeping with the tenets of the 2,000 Watt Society. It will receive 70% of its electricity and heating requirement from on-site facilities.

Erlenmatt Ost provides affordable homes for people with very different needs. In this part of the city there is a place for everyone, families, commerce, gastronomy, students and artists. What the various courtyards are used for is decided jointly by residents at local events where each can have his or her say. At Erlenmatt Ost people are very obviously the focal point. The sustainability requirements established for the future which Habitat Stiftung has laid down in the conditions of the leasehold are on the one hand clearly measurable and on the other constitute a logical, comprehensible framework that is understood and adhered to by residents. For example, one person can lay claim to no more than 45 square metres of energy consumption area – including the staircase, bathroom and corridors. In return generous communal rooms have been included. At least ten percent of the dwelling area has to serve some social purpose. Priority has also been given to



Andreas Appenzeller and Urs Buomberger

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building insulation, energy efficient electrical devices and grey energy. The energy supply concept developed by ADEV Energiegenossenschaft from Liestal will ensure the area receives energy from sustainable sources: the foundation for the district's electricity and heating supply system is firstly one of Switzerland's largest private consumer groups for solar energy (Zusammenschluss zum Eigenverbrauch ZEV [English: association for the purpose of own consumption]) and secondly the heat which is extracted from the groundwater. When completed the installed solar power capacity will be around 850 kW. Heat pumps are an enhancement to solar power. After the final stage over two thirds of the electricity and heating requirement will be produced on-site. This electricity will be sold directly to the residents as will the heat produced by ADEV without the intervention of any energy supplier. The groundwater will finally be conveyed to the premises of Hoffmann-La Roche AG where it will serve in building air conditioning and in industrial processes

There is only one parking space for every 10 dwellings, however, there is a bicycle stand for every room in the homes. Since mid-2018 one electric powered car has been made available that is "tanked up" with Erlenmatt Ost electricity and can be rented by residents. The vehicle battery serves as buffer storage so as needed – for example in the evening or during inclement weather – energy can be fed back in to the district. This is a really innovative application that is being used here for the first time in Switzerland. A further electric vehicle is already on order.

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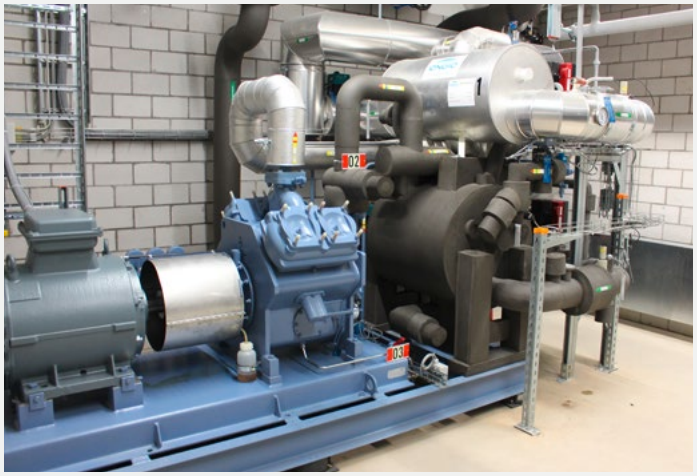
HABITAT FOUNDATION, 4058 Basel
↗ **WWW.STIFTUNG-HABITAT.CH**

ADEV ENERGIEGENOSSENSCHAFT, 4410 Liestal
↗ **WWW.ADEV.CH**

↗ **WWW.ERLENMATT-OST.CH**



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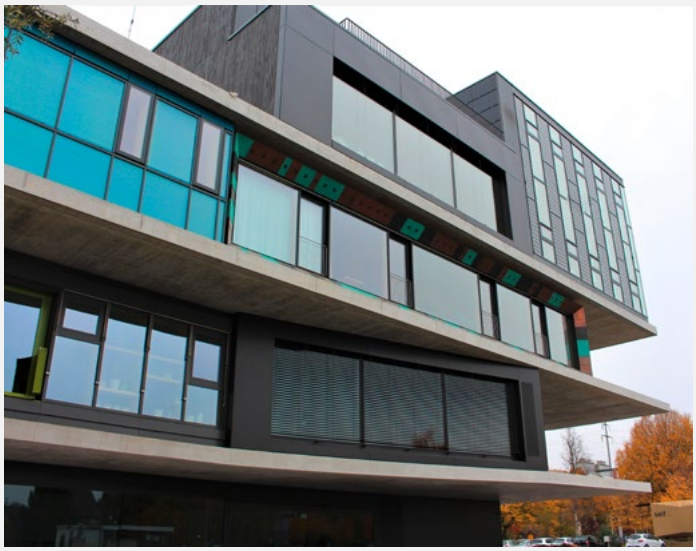
NEST – A LEGO HOUSE EXPEDITES INNOVATION

SPECIAL TRANSITION PRIZE. When we were children our curiosity knew no bounds, we had thousands of ideas that we realised creatively with Lego bricks or other building kits. We tested our constructions in play, then broke them up so that we could build a new, more refined object. Today this process is called «agile innovation». This is precisely the basic idea of the NEST (Next Evolution in Sustainable Building Technologies) research demonstrator developed by Empa and Eawag at Dübendorf in the Canton of Zurich.

In contrast to the current rapid development of new energy technologies, energy conservation and resource-saving innovations are only slowly making inroads in the building sector although such innovations are urgently needed, because about 50% of all energy consumed worldwide is used in buildings. However, investors and builders are reluctant to take a risk so they often fall back on existing solutions. NEST, which went into operation in 2016, aims to expedite innovation processes in the building sector. About 140 partners from research, the economy and the public sector are participating.



Together they can build thematic "units" on the concrete platforms of the modular NEST building to test and further develop new technologies, materials and systems under real conditions so that they can brought to market quicker if they prove suitable.

One particularly attractive NEST unit is the fitness and wellness facility designed by dransfeldarchitekten ag from Ermatingen and realised with the help of numerous partners from research and the economy. It went into operation in summer 2017 demonstrating that this popular and healthy form of recreation could also be enjoyed even when much less energy is used. The aim of the project is to lower the energy requirement by a factor of 6 in comparison to a conventional fitness and wellness facility and to cover the rest of the electricity requirement with three photovoltaic arrays on the façade and roof. And the facility is a success because of the use of high-temperature CO_2 heat pumps that can generate temperatures of over 100 °C. This heat is used a number of times consecutively by the Finnish sauna, the Turkish bath, the bio-sauna, and by the hot showers, and finally for space heating. The architecture also leaves nothing to be desired. The height of the room gives a sense of freedom and provides a view of the three floating ellipsoids which house both saunas and the Turkish bath.

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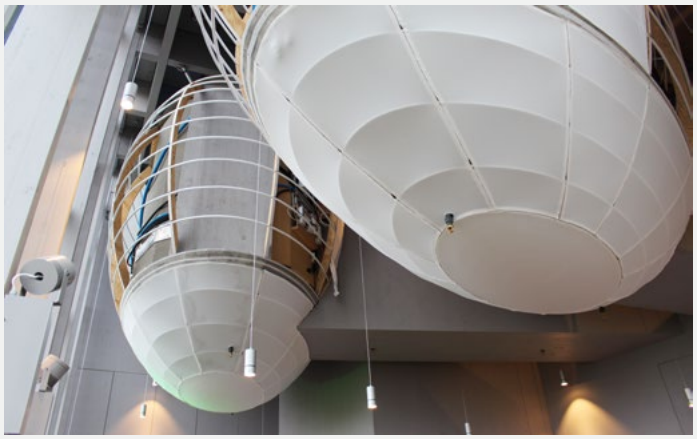
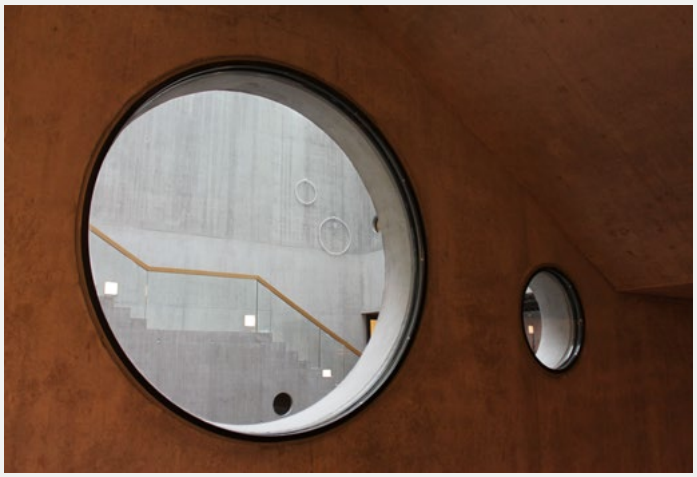
EMPA, 8600 Dübendorf
↗ **WWW.NEST.EMPA.CH**

DRANSFELDARCHITEKTEN AG, 8272 Ermatingen
↗ **WWW.DRANSFELD.CH**

NEST is in a condition of constant change like the energy world itself. The units remain for five to seven years and are then replaced by new ideas. Currently five units are in operation: Vision Wood (wood in the building industry), Meet2Create (world of work), Solar Fitness & Wellness, Urban Mining & Recycling and SolAce (façade technology). In 2019 the units DFAB HOUSE (digital manufacturing) and HiLo (lightweight construction) will be added. The Energy Hub (ehub) and the Water Hub both use NEST to further develop energy and water management at district level.





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