# ehub

## ENERGY RESEARCH AT DISTRICT LEVEL

ehub | Empa


# MASTERING THE ENERGY TRANSITION

Our energy system is changing rapidly: The expansion of renewable energy leads to a decentralized and fluctuating supply, because the sun and wind do not let us generate energy whenever and wherever we need it. Efficient storage systems and an intelligent, dynamic interaction of various technologies are required – not only in individual buildings, but also in districts and entire cities.

## RESEARCH, INDUSTRY AND THE PUBLIC SECTOR

ehub – short for Energy Hub – is Empa's energy research platform. Its goal is to enable research and business partners to optimize energy management in individual buildings and at the district level, thereby advancing the energy transition.

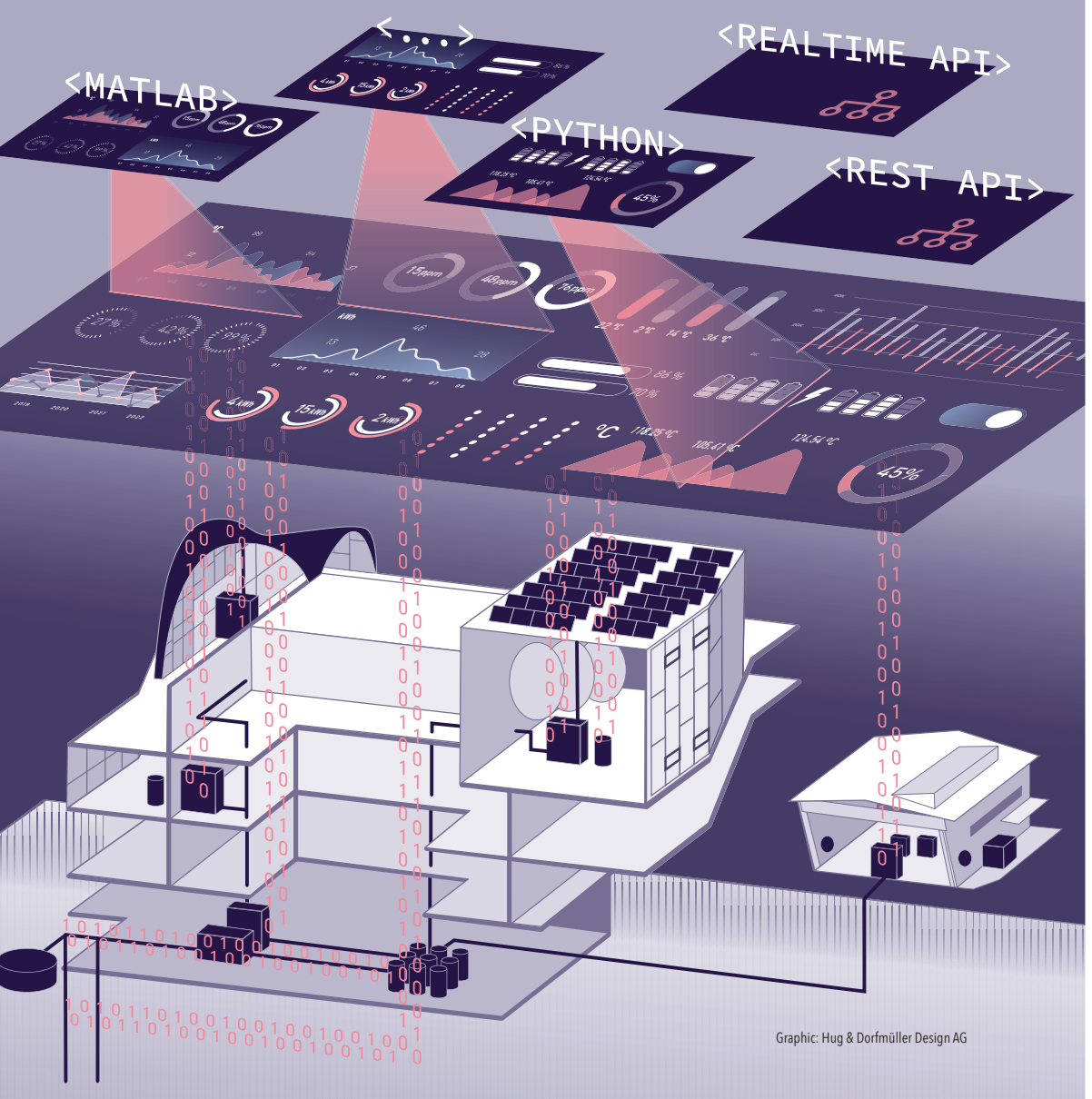

Photo: Nicolas Zonvi

## A REAL-WORLD RESEARCH DISTRICT

ehub comprises the two Empa demonstration platforms NEST and move.

NEST is conceived as a "vertical district"; it consists of a central structure and individual "buildings" – so-called units – in the form of apartments, offices and leisure facilities.

move embodies the fueling station of the future and investigates various paths towards post-fossil mobility. The focus lies on the use of seasonally surplus electricity for the production of renewable fuels.




Graphic: Hug & Dorfmüller Design AG

# EVERYTHING IS CONNECTED AND CONTROLLABLE

## CONNECT

ehub connects all on-site technologies that generate, transport, store and convert energy.

## COLLECT

Several thousand measurement points continuously gather data that are available both live and for subsequent analysis.

## CONTROL

Depending on the research question at hand, each component can be controlled individually or in combination with others – via numerous interfaces.

# FINDING ANSWERS TO YOUR ENERGY CHALLENGES IN A REAL-WORLD DISTRICT



## RUNNING EXPERIMENTS DURING ACTIVE OPERATION

ehub is open to partners from universities and research institutions. They can make use of the existing infrastructure while in full operation and validate their own control algorithms or operating scenarios in a real-world district.

### UTILIZE OUR DATA TO SOLVE YOUR PROBLEMS

Historical and live data from over 8,000 measurement points are available to partners via easy-to-use interfaces.

**ehub for research partners:** ehub.empa.ch/research

# BENEFIT FROM OUR EXPERT KNOWHOW IN ENERGY MANAGEMENT

## JOINTLY TOWARDS INNOVATION

The ehub team supports partners from industry in the development of solutions in energy management, building automation and cross-sectoral control.

### TRY OUT YOUR OWN IDEAS

Moreover, ehub offers component manufacturers the possibility to integrate their products at a very early stage into a complex energy system and analyze the interaction. Operators of energy networks can use the district infrastructure to evaluate new operating concepts in a real-world environment.

**ehub for industry partners:** ehub.empa.ch/industry


Photo: Nicolas Zonvi

# CONNECTED TECHNOLOGIES

ehub consists of a variety of components and technologies, all of which communicate with each other via a standardized data exchange. All components are part of real-life usage environments and are permanently in operation.

## FACTS & FIGURES ABOUT THE EHUB PLATFORM

**NEST:** 3 office units (approx. 540m$^2$), 3 residential units (approx. 600m$^2$), 1 fitness & wellness unit with 3 saunas (approx. 200m$^2$), central building structure with meeting and event rooms (backbone, approx. 1'500 m$^2$); further units will follow
**move:** fueling station for electric, fuel cell and gas vehicles, local hydrogen production, methanisation (starting 2021)
**Networks:** electricity, heat, gas
**Core components:**
Batteries (total 169 kWh), supercapacitors (1 kWh), heat pumps (total 142 $kW_{th}$), fuel cells (2 $kW_{th}$), ground heat exchanger (2 x 260m, 1 x 12m), ice storage (69m$^3$), photovoltaic (total 122 kWp), solar thermal (7 kWp), electrolyser (180 $kW_{el}$), $H_2$ storage (approx. 100kg), methanisation (starting 2021)

Photo: Nicolas Zonvi

# COMPREHENSIVE DATABASE

Over 8,000 data points provide real-time information on individual components, subsystems or entire units. These are stored every minute in the ehub database and are available for analysis.

## FACTS & FIGURES ABOUT THE EHUB DATABASE

**Climate data:**
Room temperature, air quality (VOC, humidity, $CO_2$), ambient temperature, solar radiation, wind direction and speed etc.

**Electrical data:**
Active and reactive power, voltage, current, frequency, charging states etc.

**Thermal data:**
Thermal energy, flow rates, temperatures, valve positions etc.

Photo: Nicolas Zonvi

# TAKE CONTROL OF THE SYSTEM

ehub not only allows the analysis of the collected data but also an active override of the control systems with your own algorithms. This enables our partners to implement new operating concepts and to validate them in reality.

## FACTS & FIGURES ABOUT THE EHUB INTERFACES

**Supported clients:**
Python, Labview, Matlab, SQL, R

**Interfaces:** REST API, Websockets, OPC UA, MQTT

**Accessibility:** via ehub Cloud, regardless of location

# TOGETHER TOWARDS A SUSTAINABLE ENERGY FUTURE

## A STRONG NETWORK

ehub is an open platform with partners from research, industry and the public sector.

### Industry Partners

ADAPTRICITY, aliunid, AurorA's Grid, BECKHOFF, BELIMO, die werke, energie360°, energie-cluster.ch, fleco POWER, +GF+, glattwerk optimal versorgt, NUSSBAUM RN, swisspower, VIESMANN climate of innovation, VSE AES, XORELLA FRANK

### Academic Partners

Bern University of Applied Sciences, csem, EPFL, ETH zürich, n|w Fachhochschule Nordwestschweiz, Hes·so, Hochschule Luzern, Paul Scherrer Institut PSI, scer future energy efficient buildings & districts

### Funding Bodies

Schweizerische Eidgenossenschaft Confédération suisse Confederazione Svizzera Confederaziun svizra – Bundesamt für Energie BFE, ccem.ch, energieschweiz, ETH-RAT, Schweizerische Eidgenossenschaft Innosuisse – Swiss Innovation Agency, Kanton Zürich, Schweizerischer Nationalfonds, SVGW SSIGE

**All partners at:** ehub.empa.ch/partner

# THINKING OUTSIDE THE BOX

## THE INNOVATION DISTRICT ON THE EMPA CAMPUS

Several research and technology transfer platforms have been established on the Empa campus in Dübendorf in recent years. Together they form an interconnected district, in which innovative and comprehensive solutions in the energy, building and mobility sectors can be developed and demonstrated in a real-world environment.

**NEST**
Exploring the future of buildings
**nest.empa.ch**

**move – Future Mobility**
Mobility without fossil fuels
**move.empa.ch**

**ehub – Energy Hub**
Energy research on district level
**ehub.empa.ch**

**dhub – Digital Hub**
Digital solutions for buildings, mobility and energy
**dhub.empa.ch**

**Water Hub**
Wastewater as a resource
**eawag.ch/waterhub**

concept&design
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2020

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