Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Bundesamt für Energie BFE
Office fédéral de l'énergie OFEN
Ufficio federale dell'energia UFE
Uffizi federal d'energia UFE







IEA HPT: Member Country Report Switzerland

Stephan Renz, Swiss Federal Office of Energy

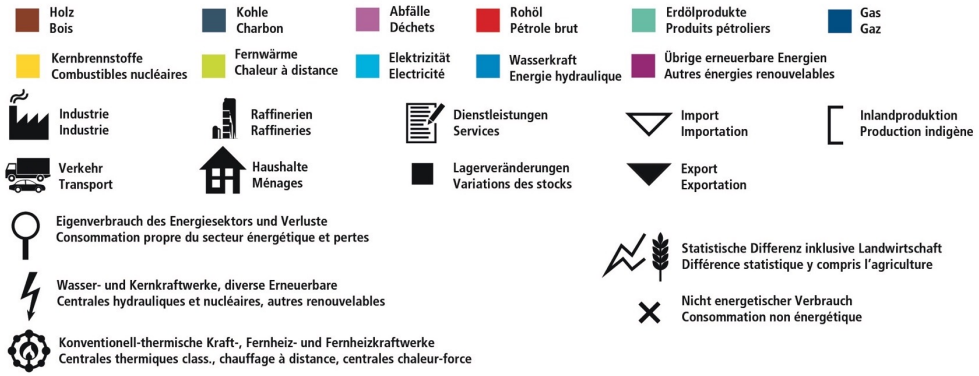
OUTLINE

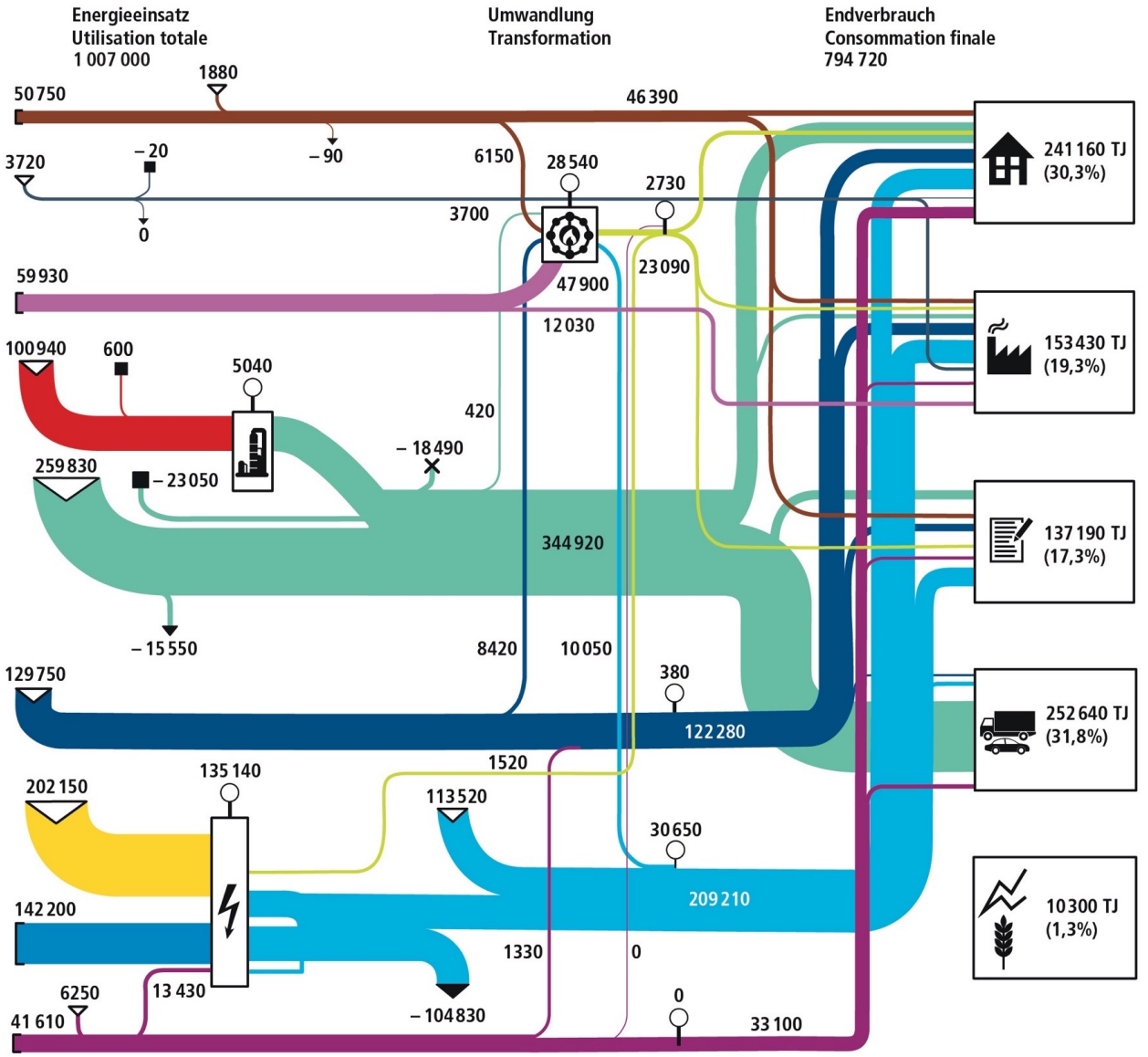
- Energy Statistics
- Development & Statistics of Heat Pumps in Switzerland
- Policy, Legislation, ….
- R&D
- Swiss Heat Pump Conference
- Examples ongoin RD&D Projects
- Contacts

ENERGY STATISTICS 2021

Detailed energy flow diagram of Switzerland

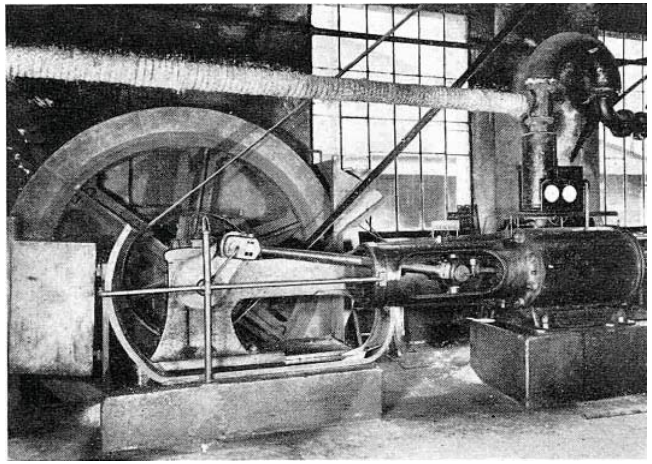
- Total Energy input 1 007 000 TJ
- Transformation
- Final energy consumption 794 720 TJ
- Housholds 241 160 TJ
- Industry 153 430 TJ
- Services 137 190 TJ
- Transport 252 640 TJ
- Agriculture, differences 10 300 TJ





https://www.bfe.admin.ch/bfe/de/home/versorgung/statistik-und-geodaten/energiestatistiken/gesamtenergiestatistik.html/

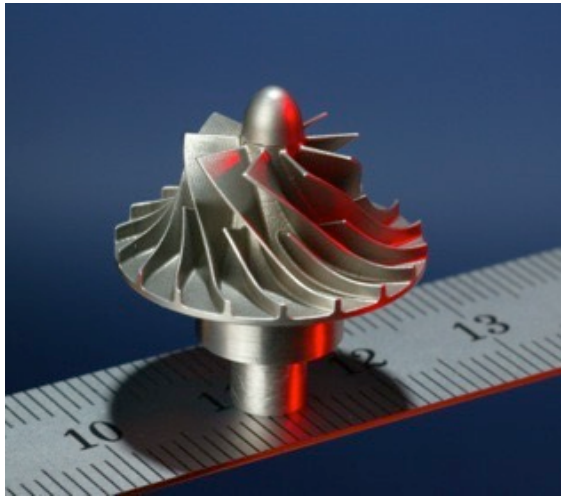
DEVELOPMENT OF HEAT PUMPS IN SWITZERLAND



Compressor of the first heat pump installed in the Bex salt works, 1878

5.86 MW Walche heat pump plant in Zurich, 1942

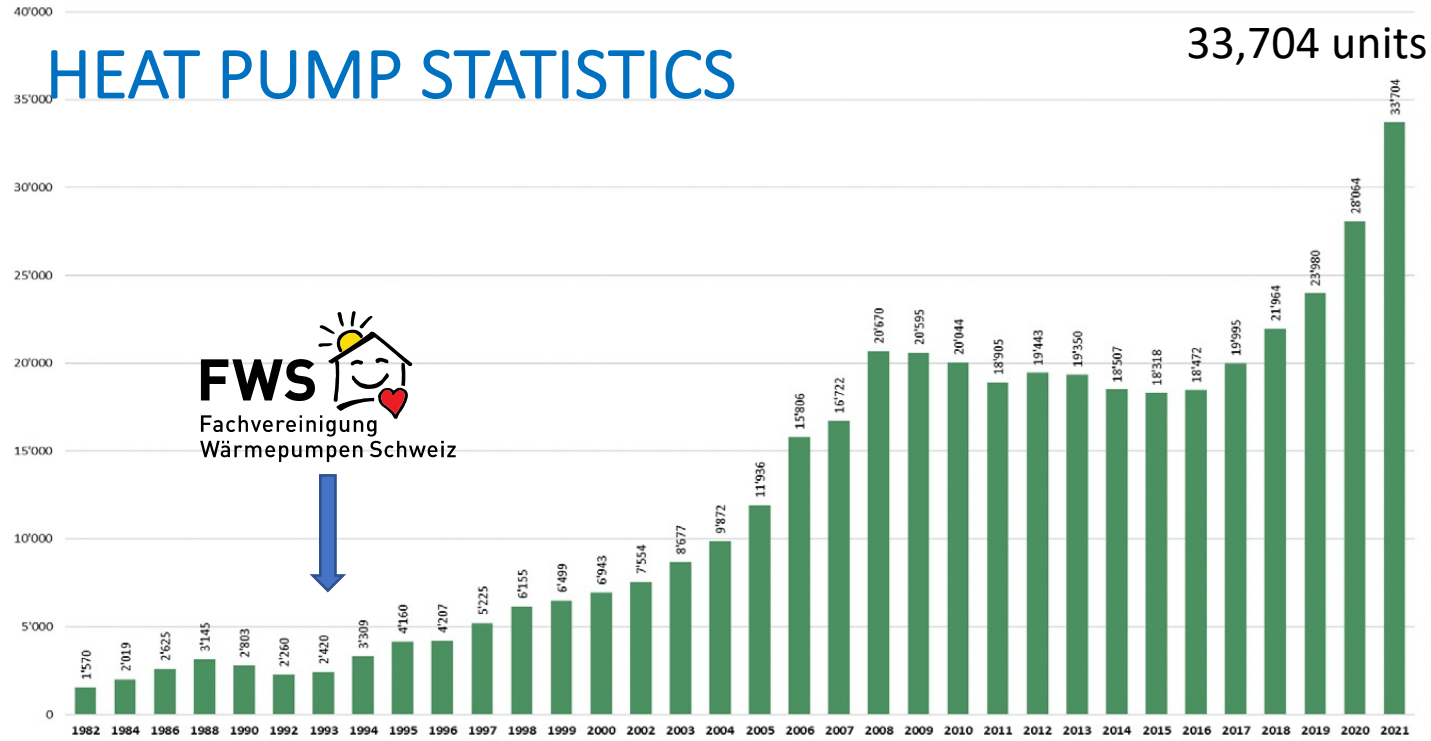
Large heat pumps (4.5 MW) use waste heat from river water power plant and supply district heating system, Birsfelden, 1984



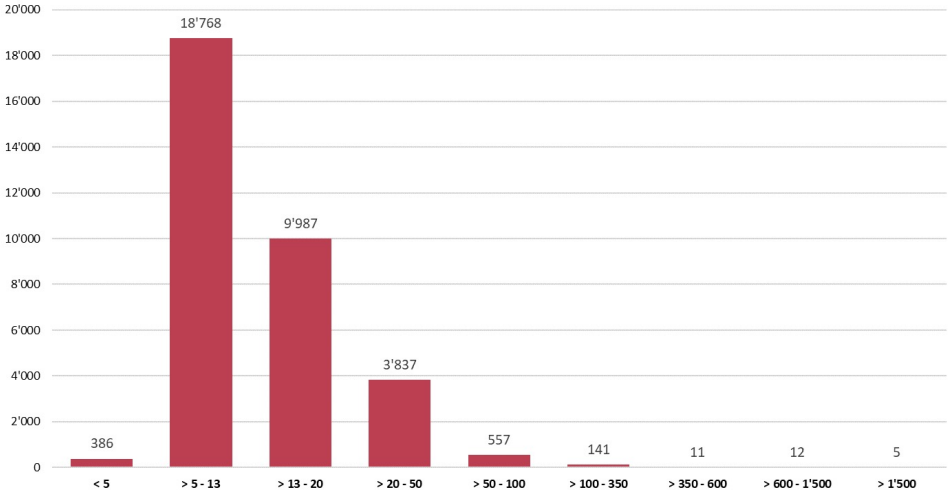
Micro centrifugal compressor for heat pumps with small power and dimension. Image: Development Prof. J. Schiffmann (EPFL)

HEAT PUMP STATISTICS

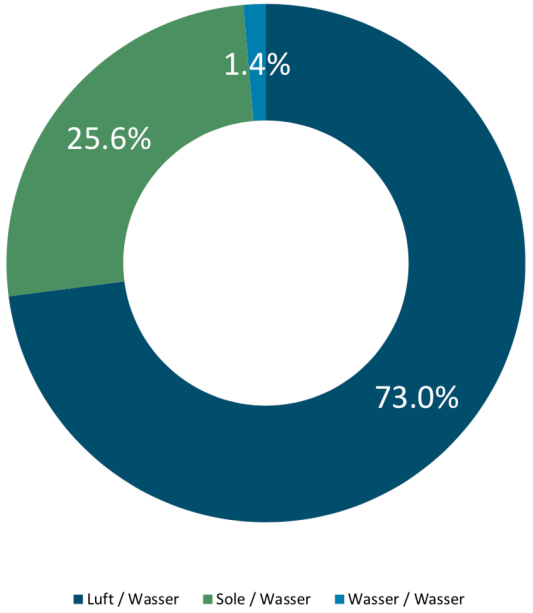
33,704 units

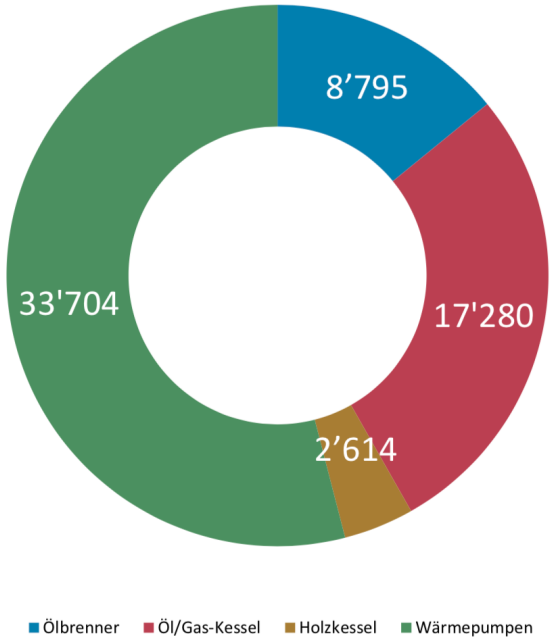


FWS
Fachvereinigung
Wärmepumpen Schweiz



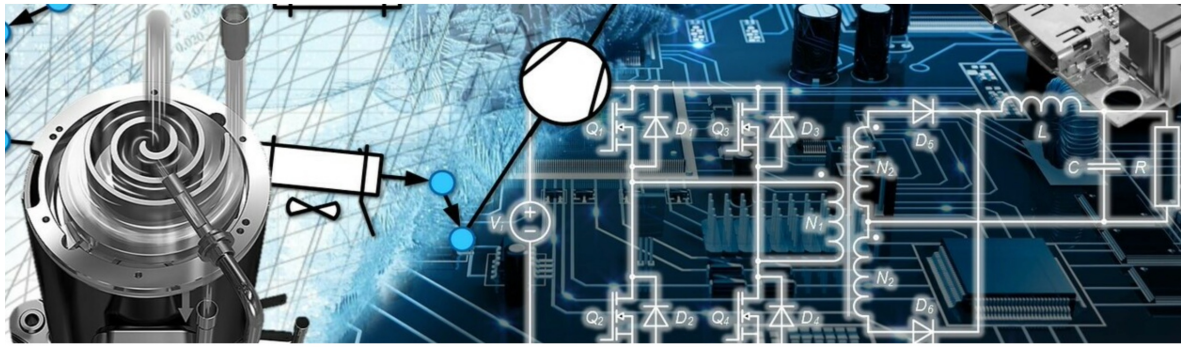
The Swiss Heat Pump Association FWS was founded in **1993** on the initiative of the Swiss Federal Office of Energy.





Source FWS Statistik 2021

QUALITY MANAGEMENT MEASURES



Home | Research and Consulting Services | Technology | System Technology | IES Institute for Energy Systems | **Heat Pump Test Center WPZ**

Heat Pump Test Center WPZ Buchs

The Heat Pump Test Center WPZ is an EN 17025 accredited inspection authority and offers comprehensive testing service in the field of heat pump and refrigeration technology.

The performance tests carried out at our test facility include the determination of the heating or cooling capacity as well as the corresponding performance figures (COP, EER).

The measurements comply with the international testing regulations EN 14511, EN 14825 or EN 16147 and the extended requirements of the EHPA inspection regulations, the ErP- or the NF guidelines. With the inspection performed at the WPZ, it is possible to obtain the international quality label (EHPA) or the registration for NF (not limited to these).

With the inspection performed at the WPZ, it is possible to obtain the international label of approval or the registration for NF.

The Heat Pump Test Center WPZ is approved to perform the following test procedures:

- EHPA test regulation
- ErP-directives (EU)
- NF-guidelines (France)
- LCP-guidelines (France)
- Heat losses according to EnV (Switzerland)
- HP Keymark regulation
- Acoustic power level measurements according to EN 12102 and ISO EN 9614

Contact

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Leiter WPZ

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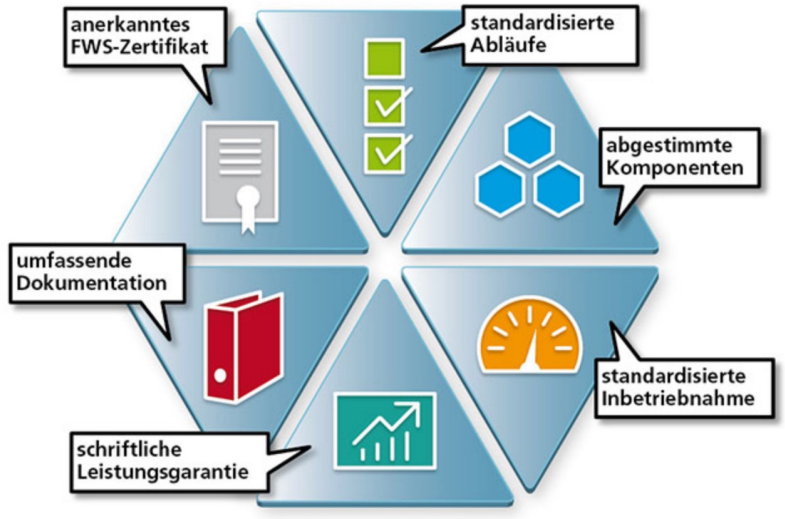
Heat Pump Test Center (WPZ)
Werdenbergstrasse 4
CH-9471 Buchs

Quicklinks

Registration heat pump testing
Heat pump test results
Heat pump field measurement
WPZ-Test rigs
Team

https://www.ost.ch/en/research-and-consulting-services/technology/system-technology/ies-institute-for-energy-systems/heat-pump-test-center-wpz



https://www.wp-systemmodul.ch/de/

FIELD MEASUREMENTS


energieschweiz

Jahresbericht, 19. Oktober 2021

Bericht «Feldmessungen von Wärme-pumpen-Anlagen
Heizsaison 2020/21»

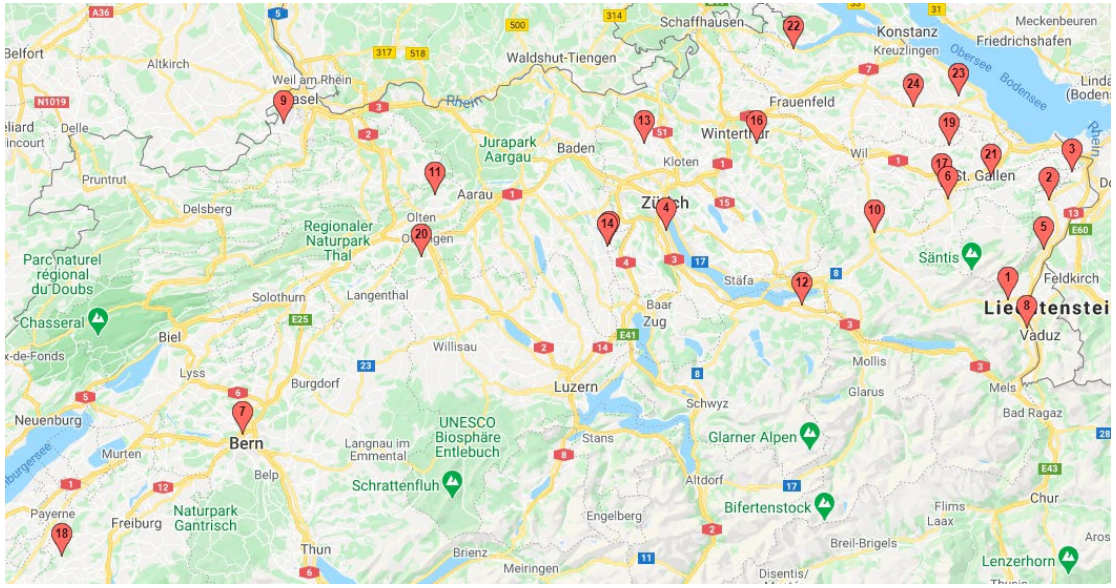
EnergieSchweiz
Bundesamt für Energie BFE

Pulverstrasse 13
CH-3063 Ittigen

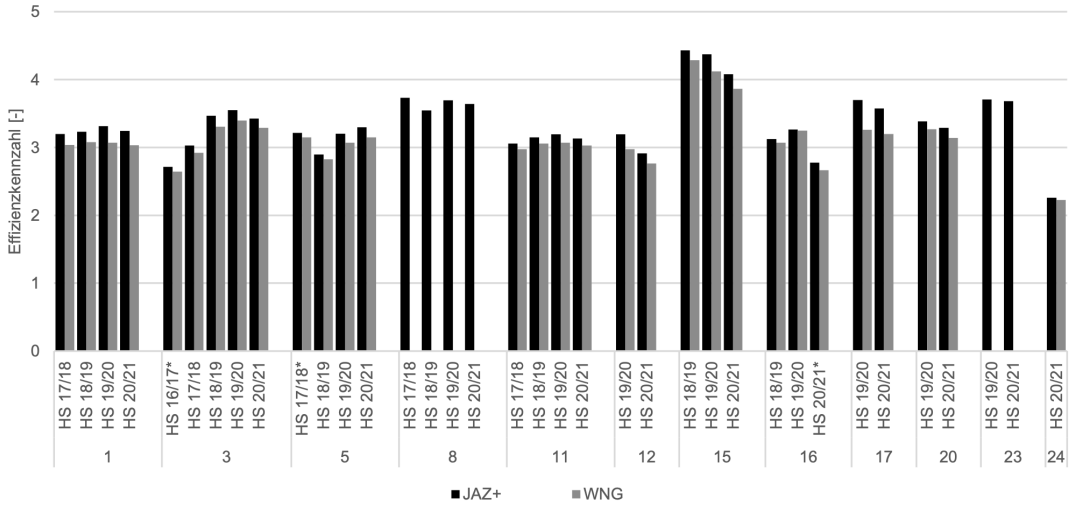
Postadresse:
CH-3003 Bern

Infoline 0848 444 444
energieschweiz.ch

Location of buildings in Switzerland with measurements



Annual performance factor (JAZ+) and heat utilization factor (WNG) of A/W-HP



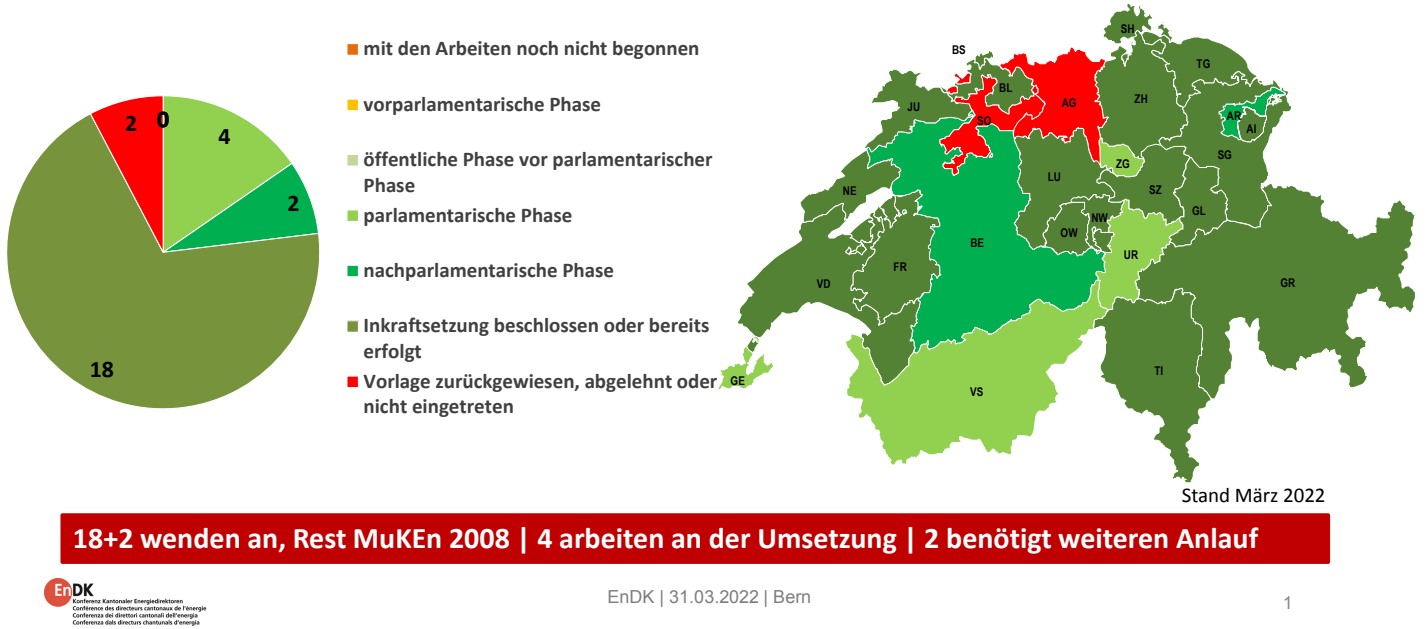
https://pubdb.bfe.admin.ch/de/suche?keywords=&q=Feldmessungen&from=&to=&nr

POLICY AND LEGISLATION

Federal

- In the wake of the reactor disaster in **Fukushima in 2011**, the Federal Council announced a new energy policy (**Energy Strategy 2050**), which included the call for a total revision of the **Federal Energy Act**. The revised Act entered into force on 1 January 2018 after it had been **accepted by a clear majority of voters in a referendum held in 2017**.
- In the **referendum of June 13, 2021, the revised CO2 Act was rejected** and …
- … lauchend a bunche of new political and legislative activities

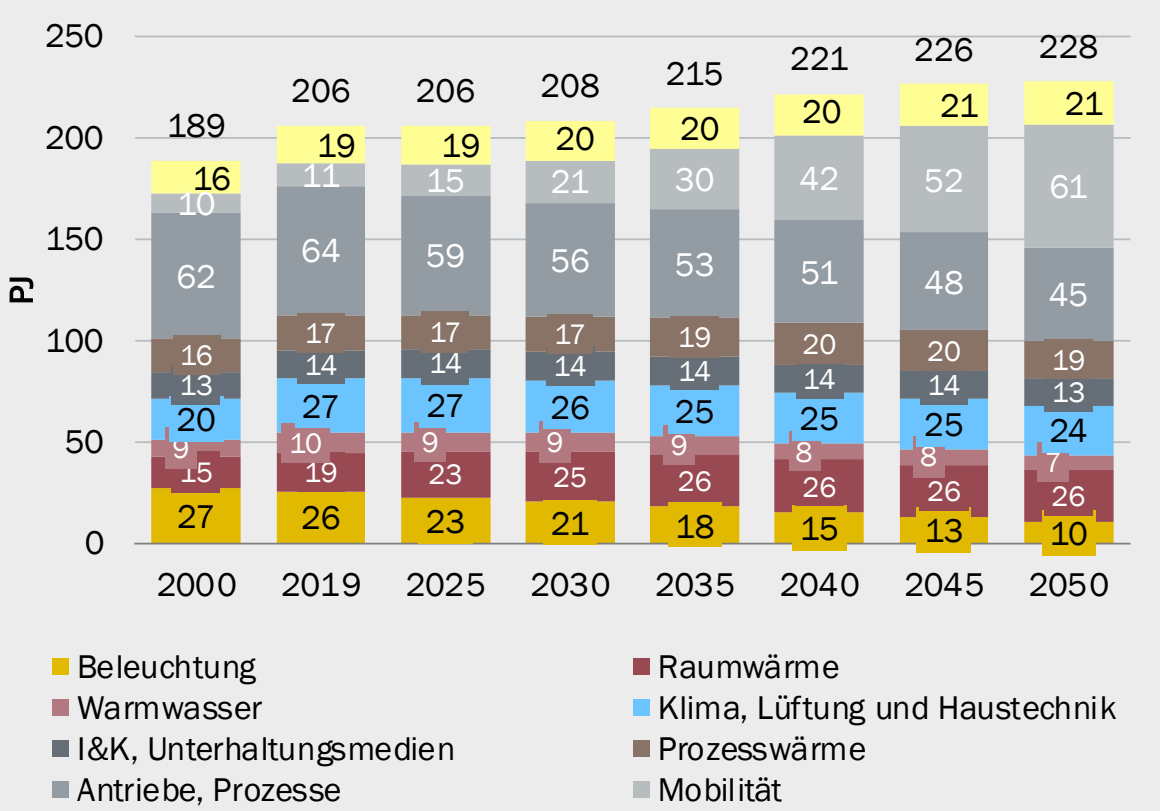
Cantons



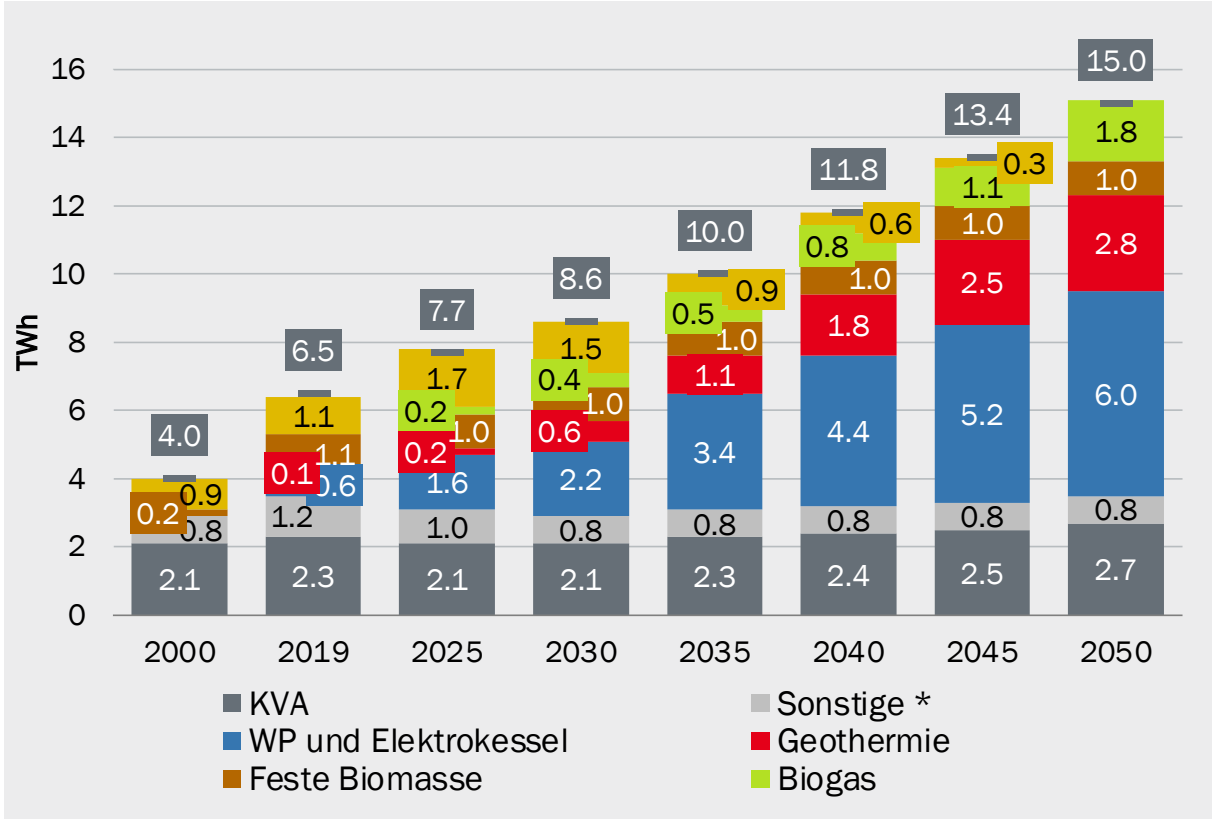
After 8 years 18/26 cantons have put into force new energy act in the building sector

ENERGY PERSPECTIVES 2050+ (ZERO Basis scenario)

Development of final energy consumption by use (in PJ)



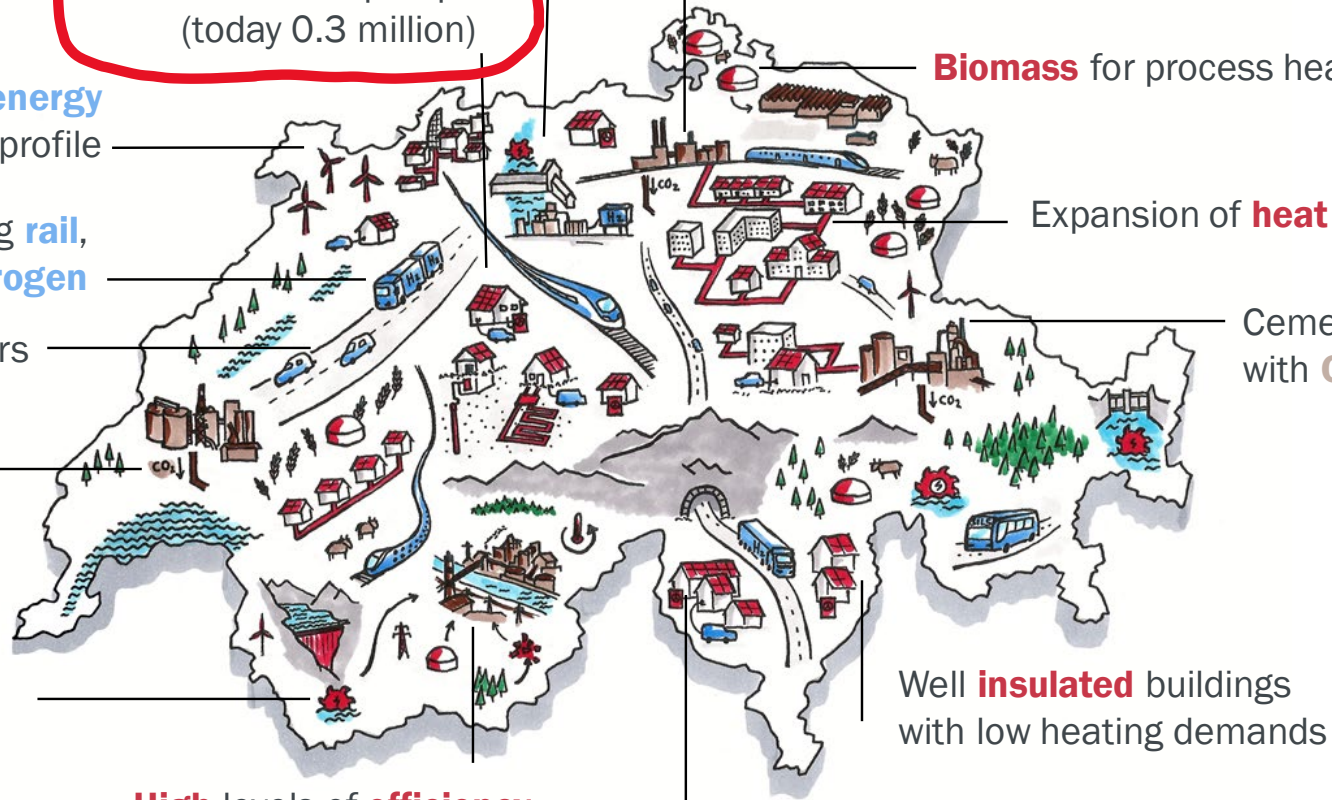
Development of consumption (incl. process heat for CCS) and generation of district heating (in TWh)



https://www.bfe.admin.ch/bfe/en/home/policy/energy-perspectives-2050-plus.html/

Source: Prognos AG / TEP Energy GmbH / INFRAS AG 2020

CLIMATE-NEUTRAL SWITZERLAND IN 2050



Hydrogen production at run-of-river sites (7 PJ)

1.5 million heat pumps (today 0.3 million)

Wind and **geothermal energy** with attractive generation profile

Heavy vehicles using **rail**, **bioenergy** and **hydrogen**

3.6 million battery-powered cars

Negative emission technologies: storage in Switzerland (3 Mt CO_2 pa)

45 TWh from hydropower (53% of production)

High levels of **efficiency** in industrial processes

Waste incineration with **CCS** (3.6 Mt CO_2 pa)

Biomass for process heat

Expansion of **heat grids** in urban areas

Cement and chemical plants with **CCS** (2.9 Mt CO2 pa)

Well **insulated** buildings with low heating demands

34 TWh from PV systems, 40% of production (today 2 TWh)

Graphics: Dina Tschumi; Prognos AG

https://www.bfe.admin.ch/bfe/en/home/policy/energy-perspectives-2050-plus.html/

FUNDING PROGRAMS FOR HEAT PUMPS

Funding programs for Heating in Industry

Funding Program	Organisation
Waste heat utilization	InfraWatt
Connection to a heating network	Basel-Stadt
Tender for electricity savings	Ausschreibung ProKilowatt (Bundesamt für Energie BFE)
Heating control ECCO2	Stiftung KliK
Wood heating systemsCanton Basel-City	
Wood heating systems (pellets, chips, logs) - on clarification also others	Energie Zukunft Schweiz AG
Agricultural biogas plantsCooperative	Ökostrom Schweiz
Mobile pellet heating systems	Stiftung KliK
New construction/extension of heating network	Kanton Basel-Stadt
Regulation and control of shaft heating systems	grischconsulta
Solar plants	Kanton Basel-Stadt
Heat pumps	Kanton Basel-Stadt
Heat pumps (air/water, water/water, brine/water)	Energie Zukunft Schweiz AG
Heat pumps for process heat	**EnergieSchweiz für Unternehmen**
Heat network	Stiftung KliK

Funding programs for Heat Pumps in Buildings

Basel-Stadt

Heat pumps that are used as the main heating system and replace an oil, gas or electric heating system are eligible for subsidies.

Air/water HP: CHF8'000.- + Fr. 250.- / kWth

Brine/water HP up to 10 kWth: max. Fr. 30'000.-
from 10 kWth: Fr. 25'500.- / system + Fr. 450.- /kWth

Additional contribution initial installation heat distribution system: Fr. 3'000.- + CHF 200.- / kW

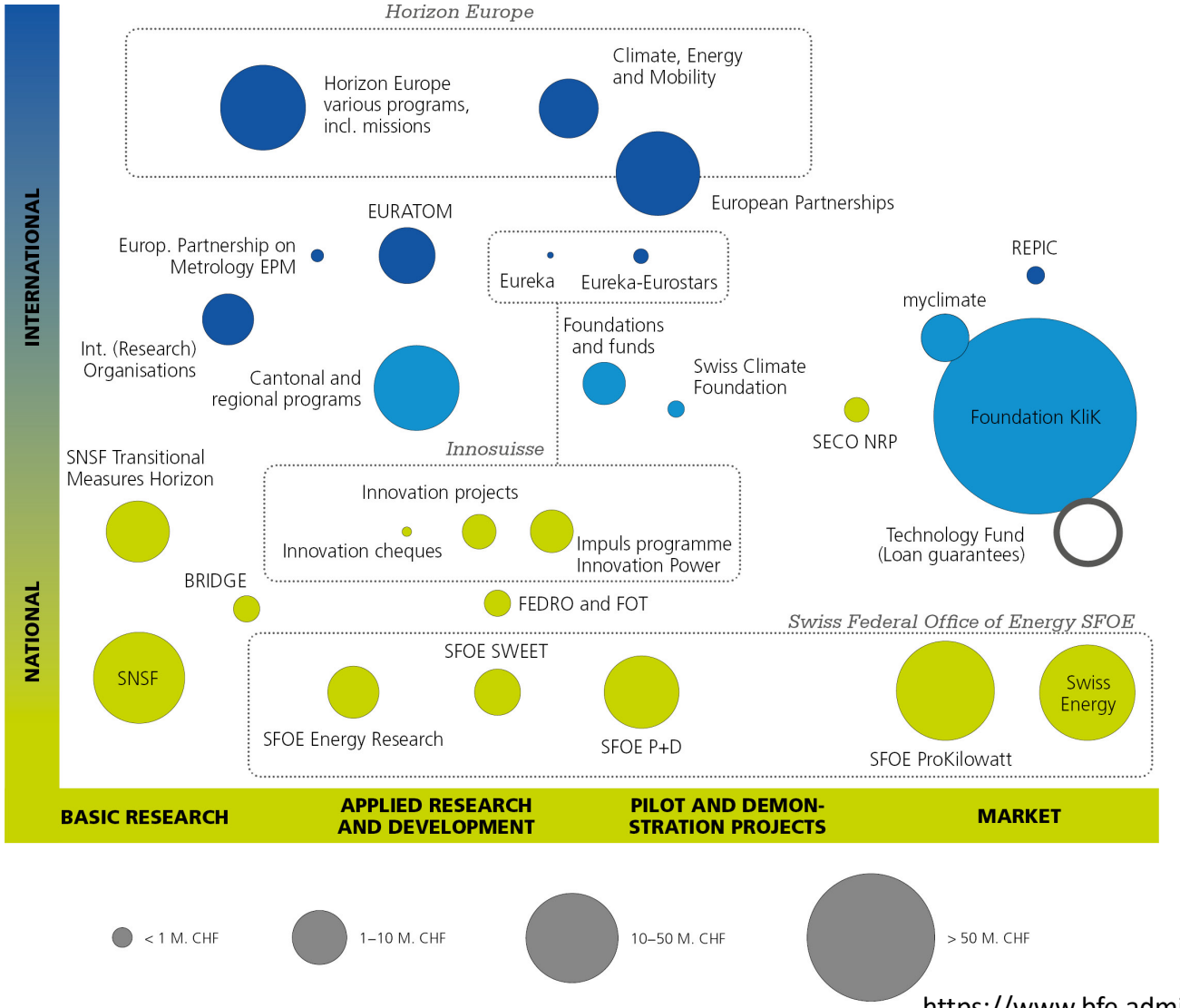
Solothurn

Only air-to-water heat pumps that replace oil, natural gas or electric heating systems in existing buildings are eligible for subsidies. The replaced heating system must be dismantled.

Air/water HP: CHF 4000.- + 150.- per kWth

Bonus for initial installation heat distribution: 1600 Fr. + 40 Fr. per kWth

ENERGY RESEARCH & FUNDING



Heat Pumps and Refrigeration

Research priorities, 2021-2024

- Technology improvement
- Special fields of application
- Climate neutral refrigerants
- Integration into application systems
- Integration into the energy system

https://www.bfe.admin.ch/bfe/en/home/research-and-cleantech/overview-of-innovation-promotion.html

ANNUAL SWISS HEAT PUMP CONFERENCE

https://www.bfe.admin.ch/bfe/de/home/forschung-und-cleantech/forschungsprogramme/waermepumpen-und-kaeltetechnik.html
https://www.fws.ch/fachpublikationen/

HTHP-CH – Integration of High-Temperature Heat Pumps in Swiss Industrial Processes

Industrial Sector	Dairy	Dairy	Food (meat)
Application/ Process Description	Several opportunities to **upgrade various heat sources** (e.g., waste heat from ammonia chillers, and from UP process) to **supply various heat sinks** (e.g, UP or UHT processes, or CIP processes).	A hot water loop operated at 105 °C to supply various processes currently being heated by a **district heating** supplied by a waste incineration plant. In case of a possible future decrease of the district heating supply temperature, a **HTHP** could be used to **upgrade the heat to 105 °C.** **HTHP integration in a milk permeate drying plant** supplied by 3 bar(g) steam and operated continuously could be another opportunity to analyze.	**Sausage cooking and smoking, steam demand at 115 °C.** Operation 12 h per day **Waste heat** is available as heat source from **ammonia refrigeration units at 40 °C to 50 °C**

Swiss Federal Office of Energy SFOE

OST Eastern Switzerland University of Applied Sciences

EPFL

HEIG VD

CSD INGENIEURS – INGÉNIEUX PAR NATURE

- Project management
- Simulation/modeling
- Responsible for all WPs
- Reporting
- Dissemination
- Participation IEA Annex 58

HPT

Further projects

- IntSGHP
- DeCarb-PUI
- DeCarbCH

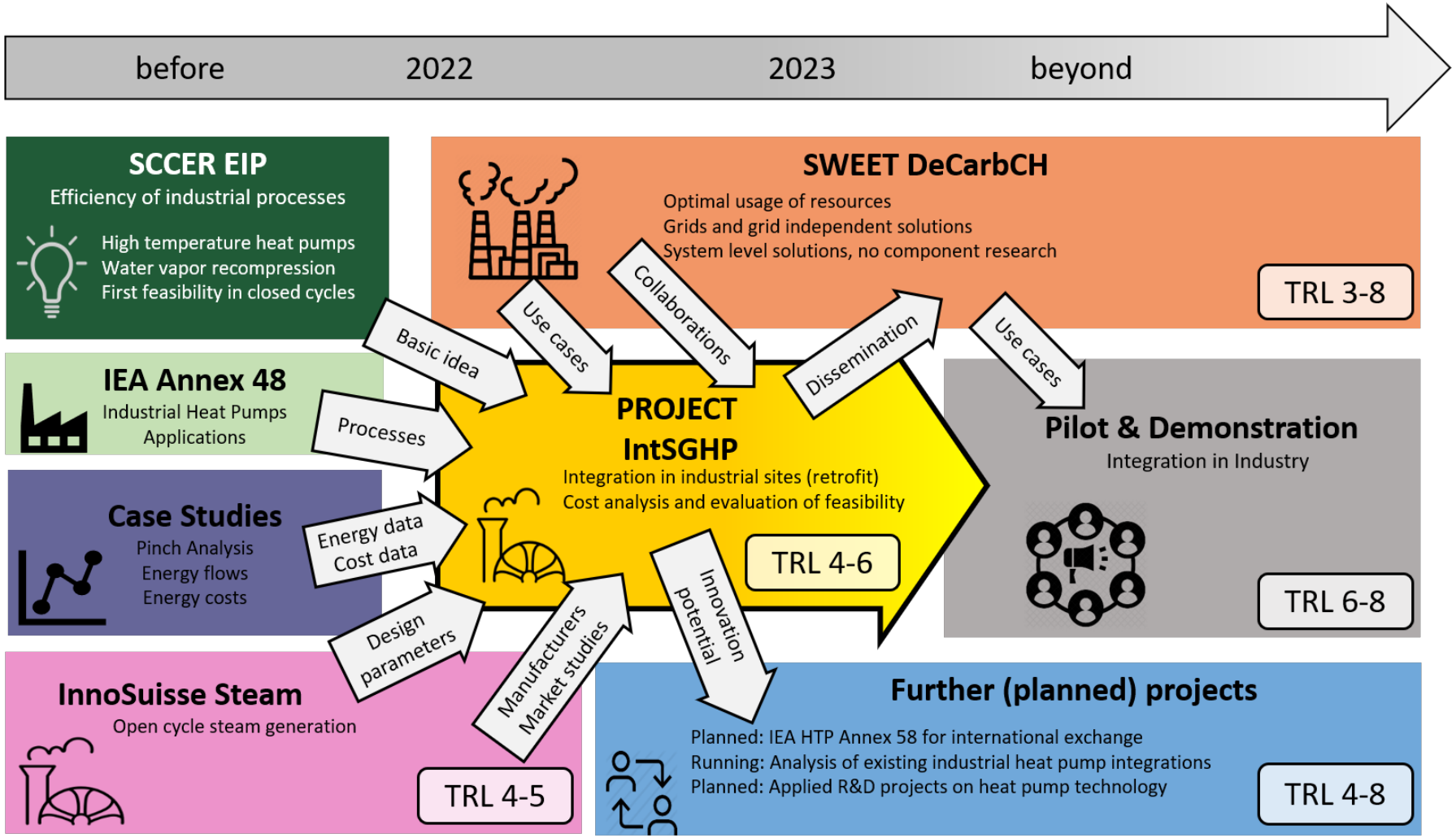
sweet swiss energy research for the energy transition – DeCarbCH

Workshops with stakeholders

- Planners
- Consultants
- Installers
- Manufacturers

Source: CSEM 06.2022

HTHP-CH – Integration of High-Temperature Heat Pumps in Swiss Industrial Processes



Goals are
Integration & Guidelines

Helping 3 Swiss industrial sites with the integration of steam generation heat pump systems

Finding optimal solution using data analysis, process integration, market availability, etc.

Preparing for the demonstration of an integration

Sharing the experience and creating guidelines for other companies

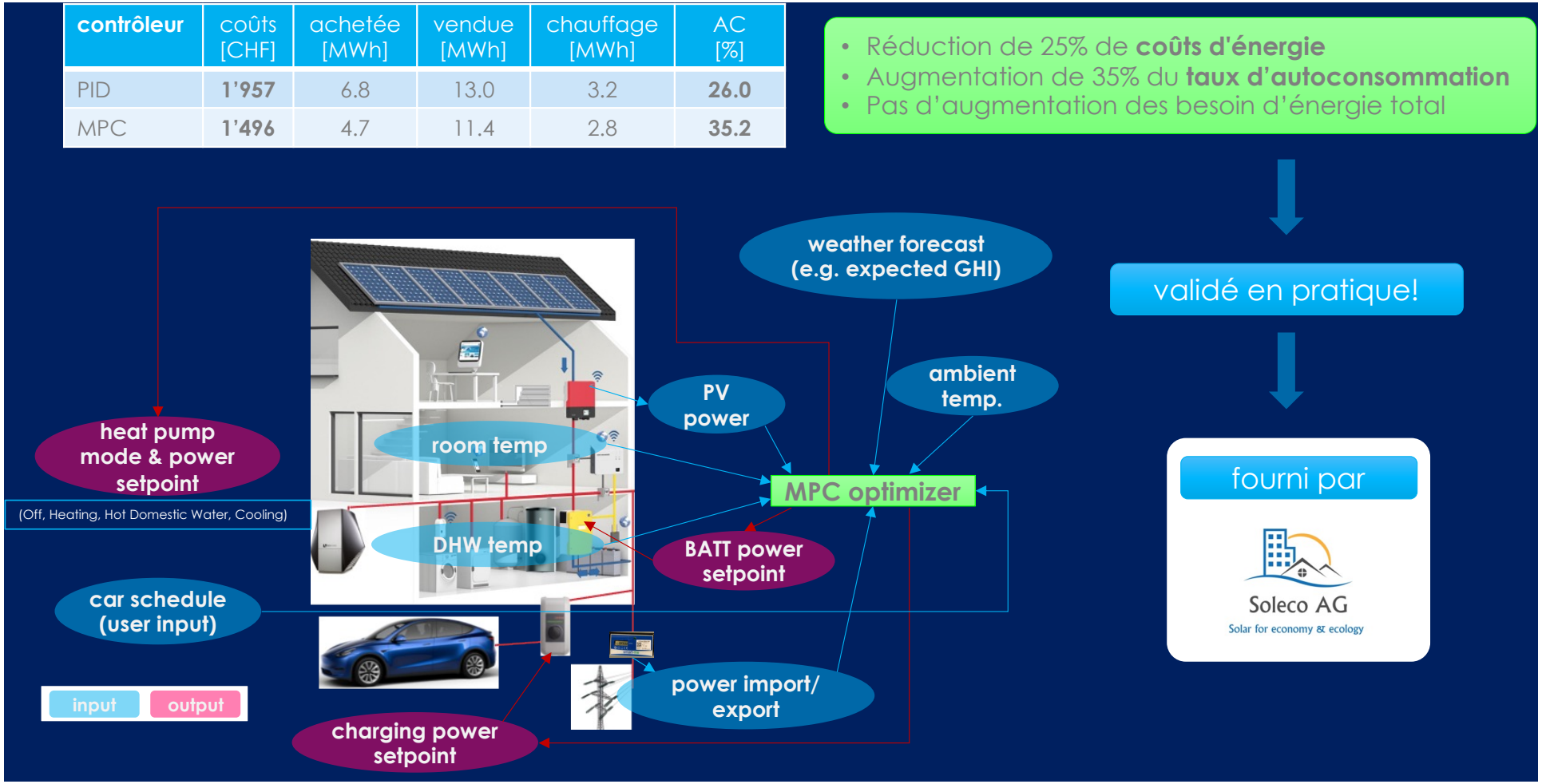
Source: OST 06.2022

OPERA - Optimal use of renewable energy with heat pumps for multi-family buildings under renovation

The benefits of predictive control (MPC)

contrôleur	coûts [CHF]	achetée [MWh]	vendue [MWh]	chauffage [MWh]	AC [%]
PID	**1'957**	6.8	13.0	3.2	**26.0**
MPC	**1'496**	4.7	11.4	2.8	**35.2**

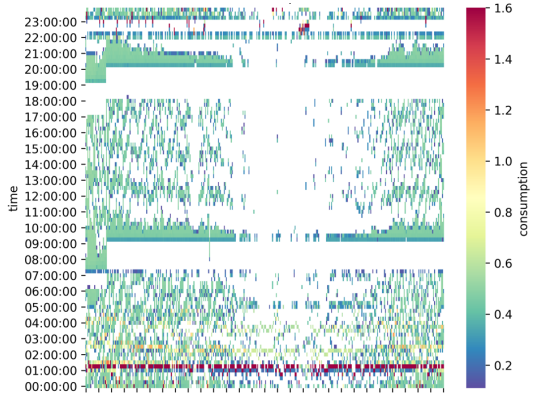
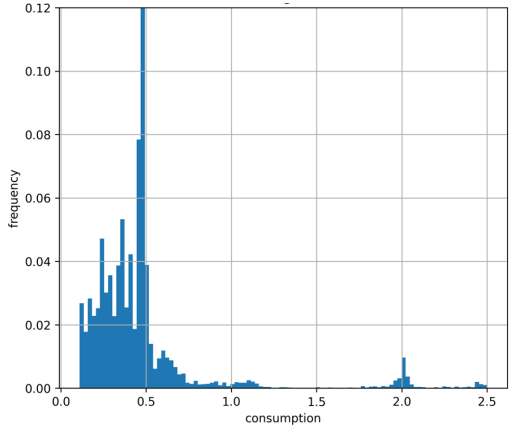
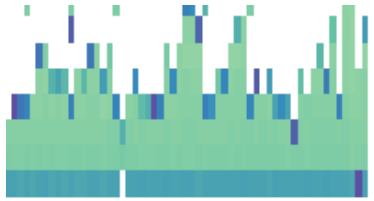
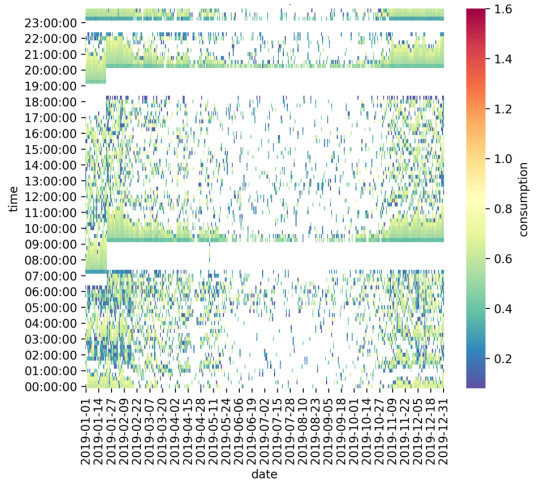
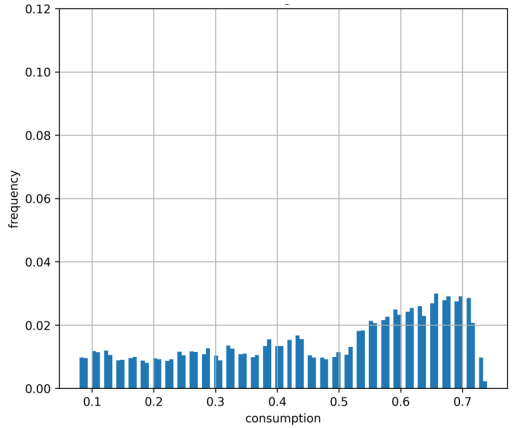
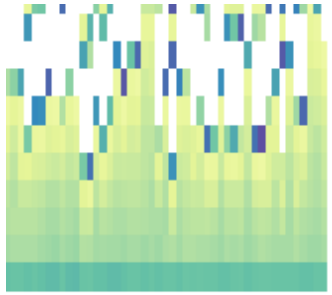
- Réduction de 25% de **coûts d'énergie**
- Augmentation de 35% du **taux d'autoconsommation**
- Pas d'augmentation des besoin d'énergie total



Source: CSEM 06.2022

Artificial intelligence for heat pump services – Machine learning for heat pump parameters with smart meter data

Example: Variable Speed vs. Fixed Speed Heat Pumps

	Heat Map:	*Histogram:*	*Heat Map – Zoomed:*
Fixed Speed Heat Pump			
Variable Speed Heat Pump			

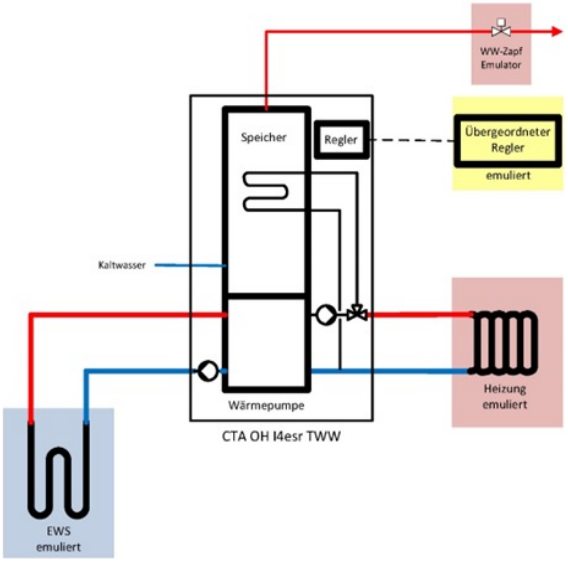
TSource: Tobisas Brudermüller, Bits to Energy Lab, ETH Zürich

HPCosy - Heat Pump Comfort System

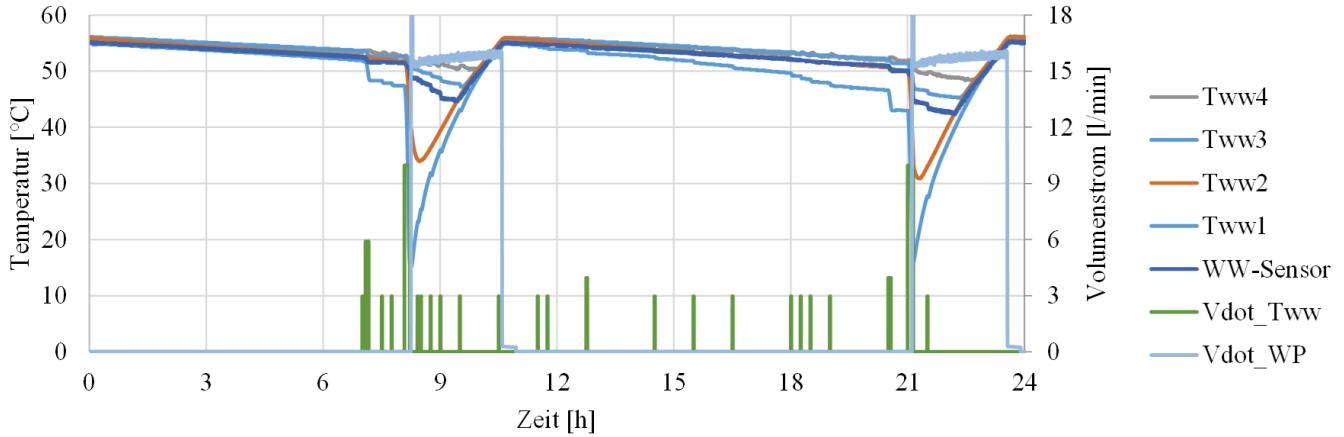
Development of a decentralized brine-water heat pump system for **apartments** in multi-family houses (MFH). This **includes the functions of heating, cooling and hot water production.**

Heat pumps are installed in the apartments or on the floor. The brine is distributed in the building.

Wärmepumpensystem Optiheat Inverta TWW - CTA AG



Schema der Labormessung



Warmwasserspeicher, Temperaturen und Volumenströme

Source: FHNW 06.2022

Areal-Überbauung Möriken-Wildegg

3 identical residential buildings with different heat pump concept

RTB setz Architektur

- 4 MFH, 35 apartments, Minergie-P-Eco construction, wood/mixed "Swisswoodhouse" construction
- 4 heat pump systems with geothermal probes and "Natural Cooling".
- P-systems east/west, facades, terrace parapets, total 160 kWp
- Interconnection for self-consumption (ZEV)
- Control of the entire site with distributed intelligence and "electricity exchange

Building 1: No optimization, only DHW production during the day (fixed time program).
Building 2: Simple optimization with overboosting of the buffer tank and WW production during the day.
Building 3: Full optimization with active use of the building as a thermal storage.

Building 3: Increase factor of about 2 in the solar coverage of the HP
With an intelligent control no reduction of the efficiency (in contrast to the pure storage increase).
With an integral thermal management, the comfort is not impaired by this, but even increased.

CONTACTS

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Thanks for your attention