Energy Week 2024
PATHFNDR CONFERENCE

Input presentation

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Flexibility from building inertia and coordinated heat pump activity

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What is thermal inertia and how to access it?

- A typical single-family house has 150 – 250 tons of concrete, plaster and bricks.

- Heat emission systems such as radiators and underfloor heating heat up a significant share of this mass.

→ for 100 m^2, medium weight, 2 °C spread:

Capacity of 92 kWh ≅ 1500 l water tank (50°C)

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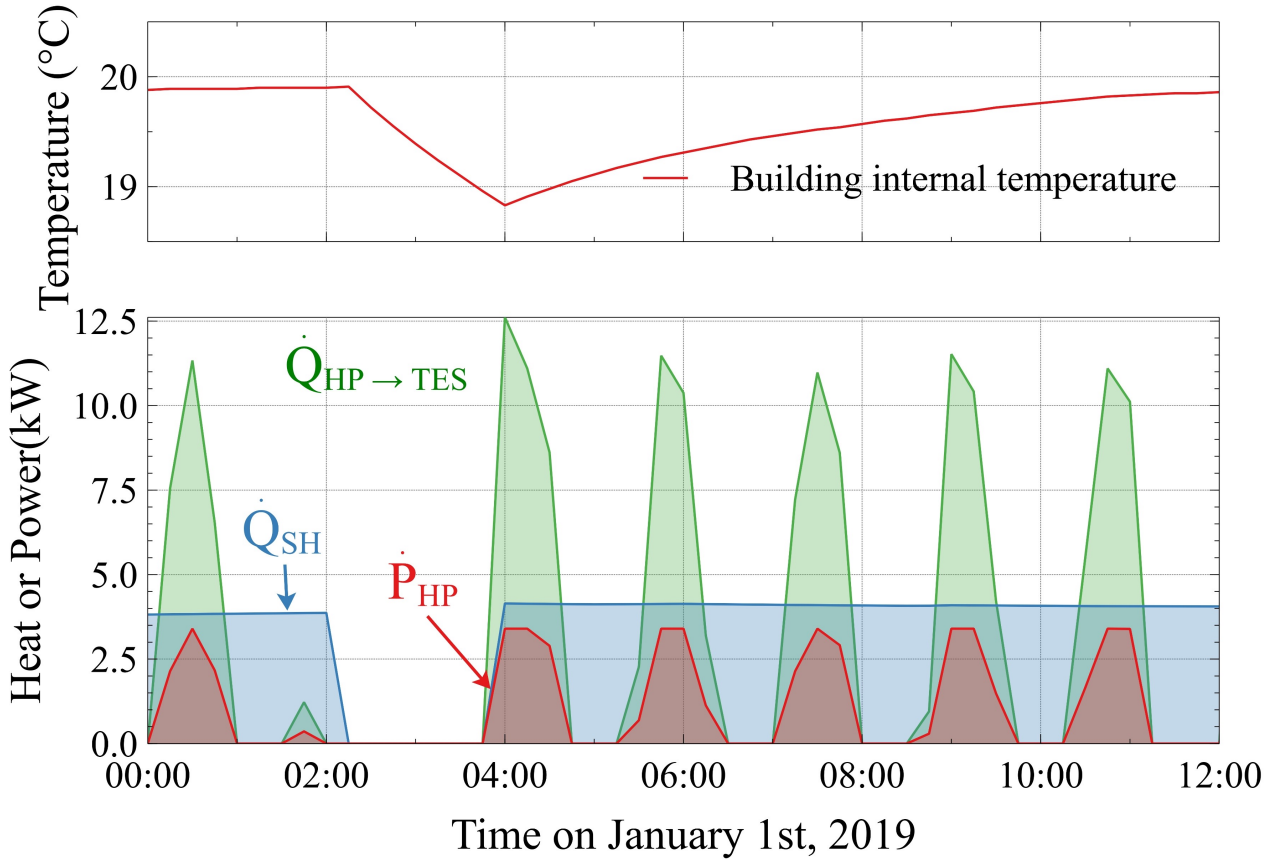
Quelle: Adobe Stock, ISO 52016-1:2017

How to turn thermal inertia into flexibility?



Simulated room temperature and heat pump activity

- The thermal inertia of the building slows down the temperature drop in a building/room.
- Temperature changes up to 1 °C are not noted by (typical) inhabitants

→ When the thermal capacity is high and/or the losses are small, we can switch off the heat pump without the inhabitant noticing it.

→ Flexibility

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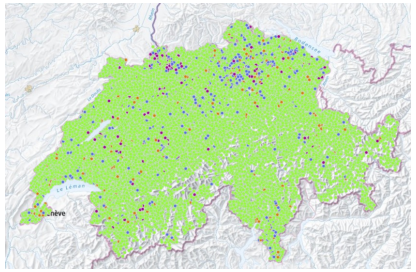
How to estimate the heat demand?

Federal register of buildings/ dwellings (RBD/GWR)



Federal office of energy statistics

GEAK
Gebäudeenergieausweis der Kantone

Process flow

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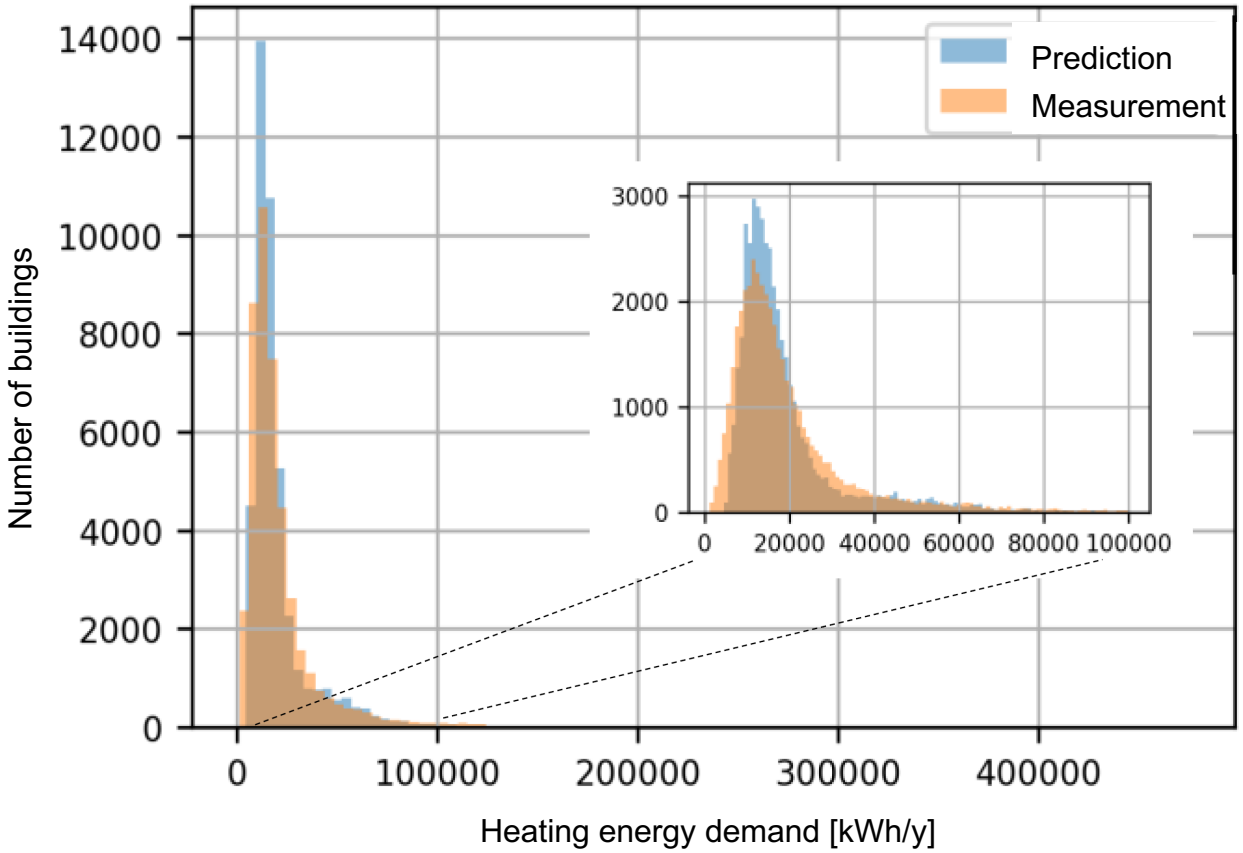
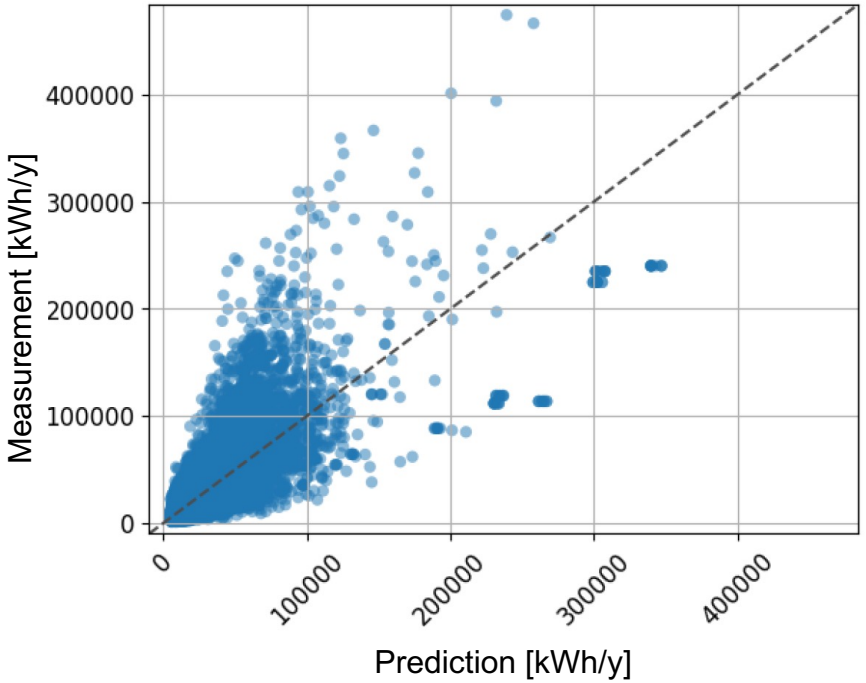
How accurate is it?





Case study:
Gas/district heating demand of buildings in canton Basel-Landschaft

Mean percentual error: 38.1 %

See Sarah's Poster for details

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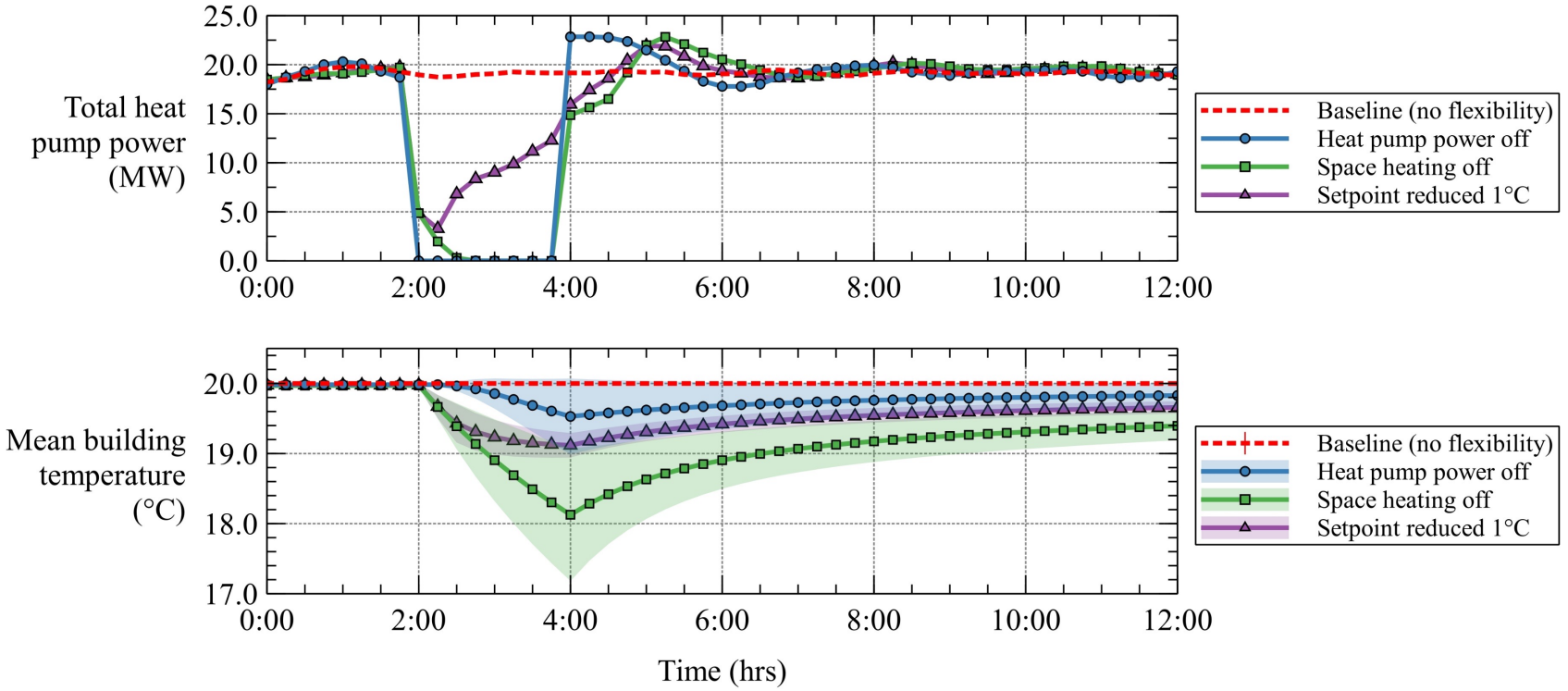
Quelle: S. Schönenberger et al. Wärmebedarfschätzung für Wohngebäude

How much flexibility can we provide for Liestal?



Case Study in Liestal (BL):

- > 2000 heat pumps (HP)
- dynamic building model

Control modes:

- *HP off:* all HP off during 2h
- *Space heating off*: No space heating during 2h
- *Set point reduced by 1°C*

Observations:

- 100 % reduction for 2 h is possible, but whiplash of 12 % after control (HP off mode)
- Rebound can be deferred by 1.5 hours (Space heating off), but causes discomfort
- Loss of comfort can be evaded at the price of a smaller reduction

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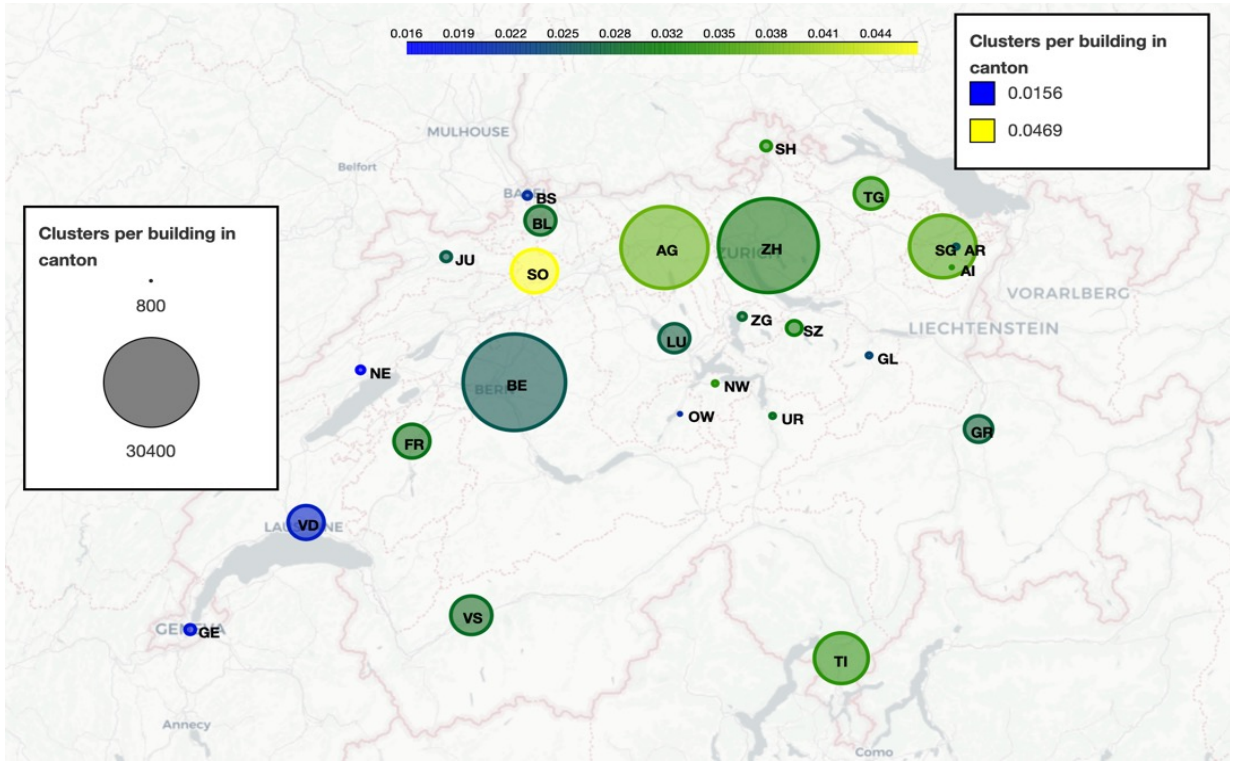
Confer Curtis' Poster for details

Where could heat pumps help to decarbonise and provide flexibility?



Scalability study Nanoverbund concept:

Find locations where heat pump is surrounded by fossil heating system in less than 30 meters inter-system distance.

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What have we learned?

- Public data enable the estimation of **individual building heating load** (profiles) with an **average percentual deviation of 38 %**
- **Coordinated control** enables the **reduction** of the **heat pump load** without comfort loss (up to 100 % reduction possible)
- **Rebound of control event** may be **deferred** if **weaker reductions** are acceptable (up to 75 % of reduction period)
- **Concept** of covering (parts of) the **heating** load of a **fossil-heated** building with the **neighbour's heat pump** is **well scalable** across Switzerland

Call for participation

We *offer*:

- Heat demand profiles
- Heat pump profiles
- Procedures to estimate flexibility and mitigate peak loads

Please contact us

We *search* for:

- **Building/Site owners/Planners:** Using profiles for planning process
- **Utilities**: Interested in flexibility aware planning or operation
- **Cantonal offices**: Identifying suitable districts for flexibility aware operation

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The **thermal inertia** of buildings combined **with suitable heat pump control** is a low-to-no-cost alternative to provide flexibility for the Swiss energy system.