

Innovation District Inffeld

Gerald Schweiger

Priv. Doz. Dr. PhD. Mag. MA MA



[...] *Those who have a why ... can bear most every how...*

~ 20 - 40 %
*Intelligent
control*

~ 40 %
buildings





[...] *Those who have a why ... can bear most every how...*



~ 15 - 30 %

Fault detection & diagnosis

~ 50 %
Commercial buildings

[...] **Intelligent** Energy Systems Lab

Intelligent Energy Systems Group

@ Institute of Software Technology, TU Graz

- Intelligent systems, buildings, ...
- Bridging the gap: basic & applied research

Core topics

- Computational methods and AI
- IoT and semantic data

Collaborations & Open Science

- IBPSA Project 1; IEA Annex 81
- GRAML; Innovation District Inffeld, Inframonitor
- Open data, Open source & Open standards

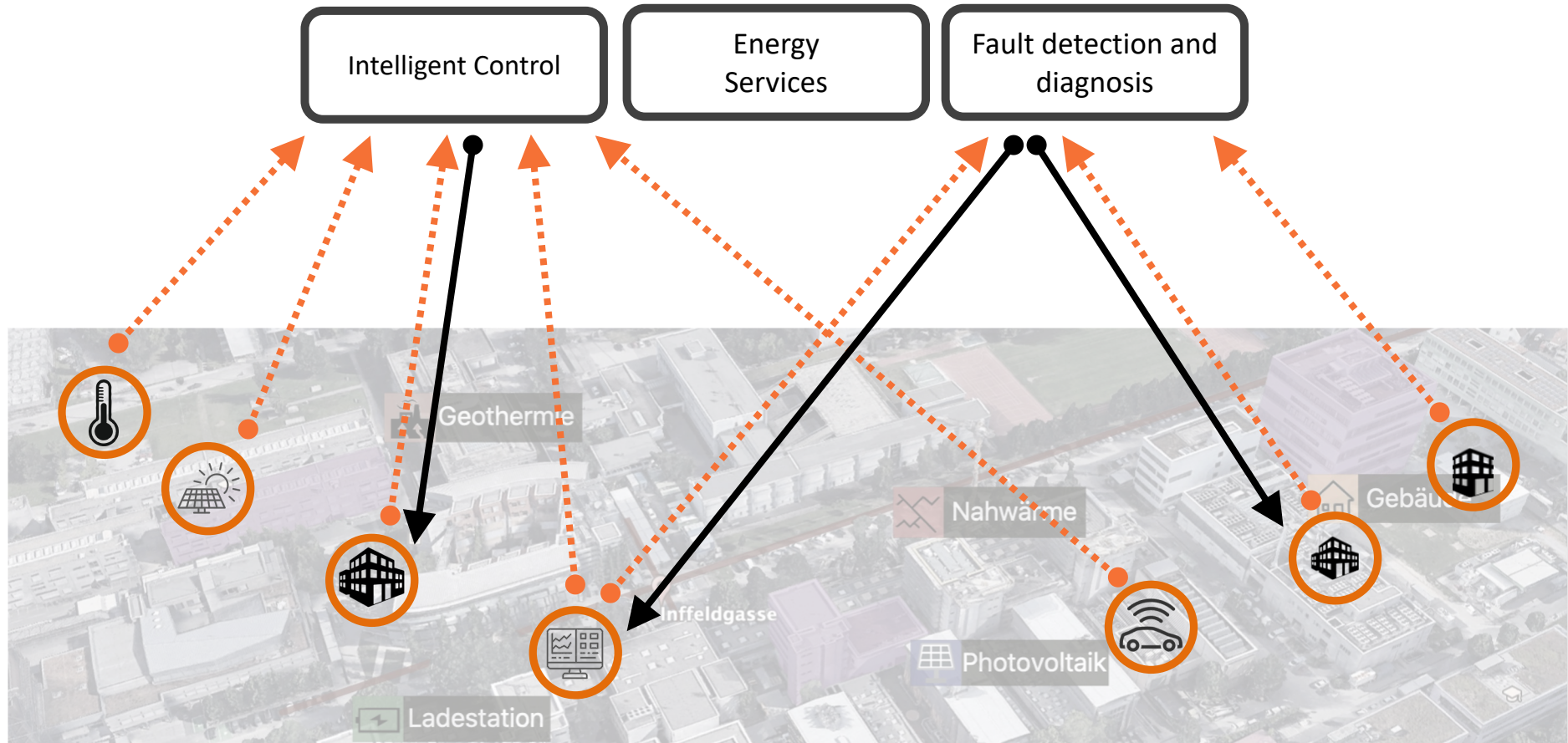


[...] starting point and motivation

How make use of
data outside silos?

Scalable, robust, ...
Energy Services

Two key challenges



Agenda

Internet of Things

Semantic Data

Inframonitor

Active User Participation

Problems

[...] Internet of Things

Data Analytics

Fault detection and diagnosis

.....

Visualization

Intelligent Control



Geothermie

Ladestation

Inffeldgasse

Nahwärme

Photovoltaik



Gebäude

Intelligent
Control

What do we want to know from each entity?

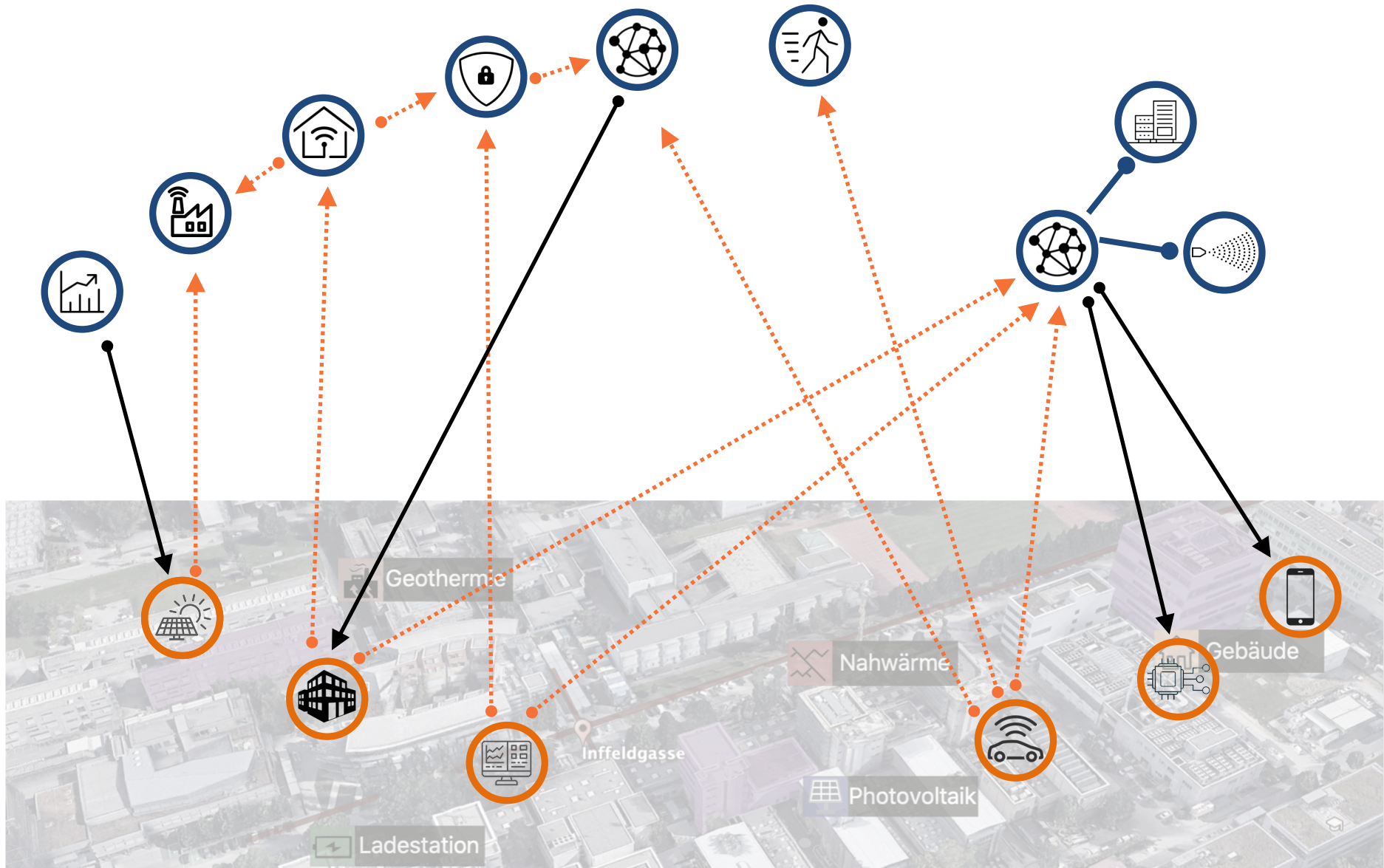
- What are you?
- How is your relation to other entities?
- What is your current status/value?
- What were your historical statuses/values?

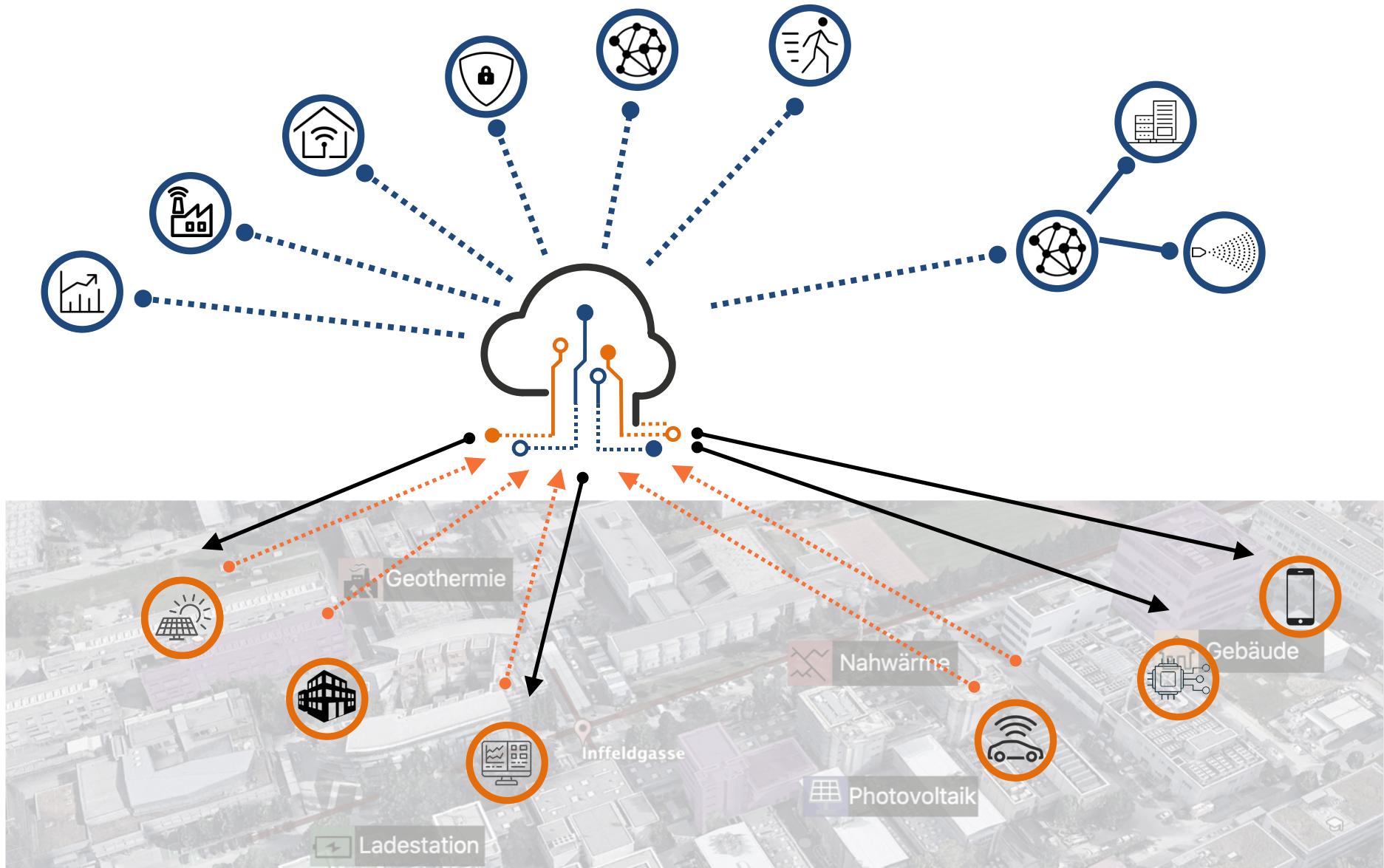


Intelligent
Control

How do we get these data/information?























Open Access

Feature Paper

Article

IoT Middleware Platforms for Smart Energy Systems: An Empirical Expert Survey

by  Qamar Alfalouji ¹ ,  Thomas Schranz ¹ ,  Alexander Kümpel ²  ,  Markus Schraven ²  ,  Thomas Storek ^{2,3}  ,
 Stephan Gross ⁴ ,  Antonello Monti ^{4,5}  ,  Dirk Müller ^{2,3}  and  Gerald Schweiger ^{1,*} 

¹ Institute of Software Technology, Graz University of Technology, 8010 Graz, Austria

² Institute for Energy Efficient Buildings and Indoor Climate, E.ON Energy Research Center, RWTH Aachen University, 52074 Aachen, Germany

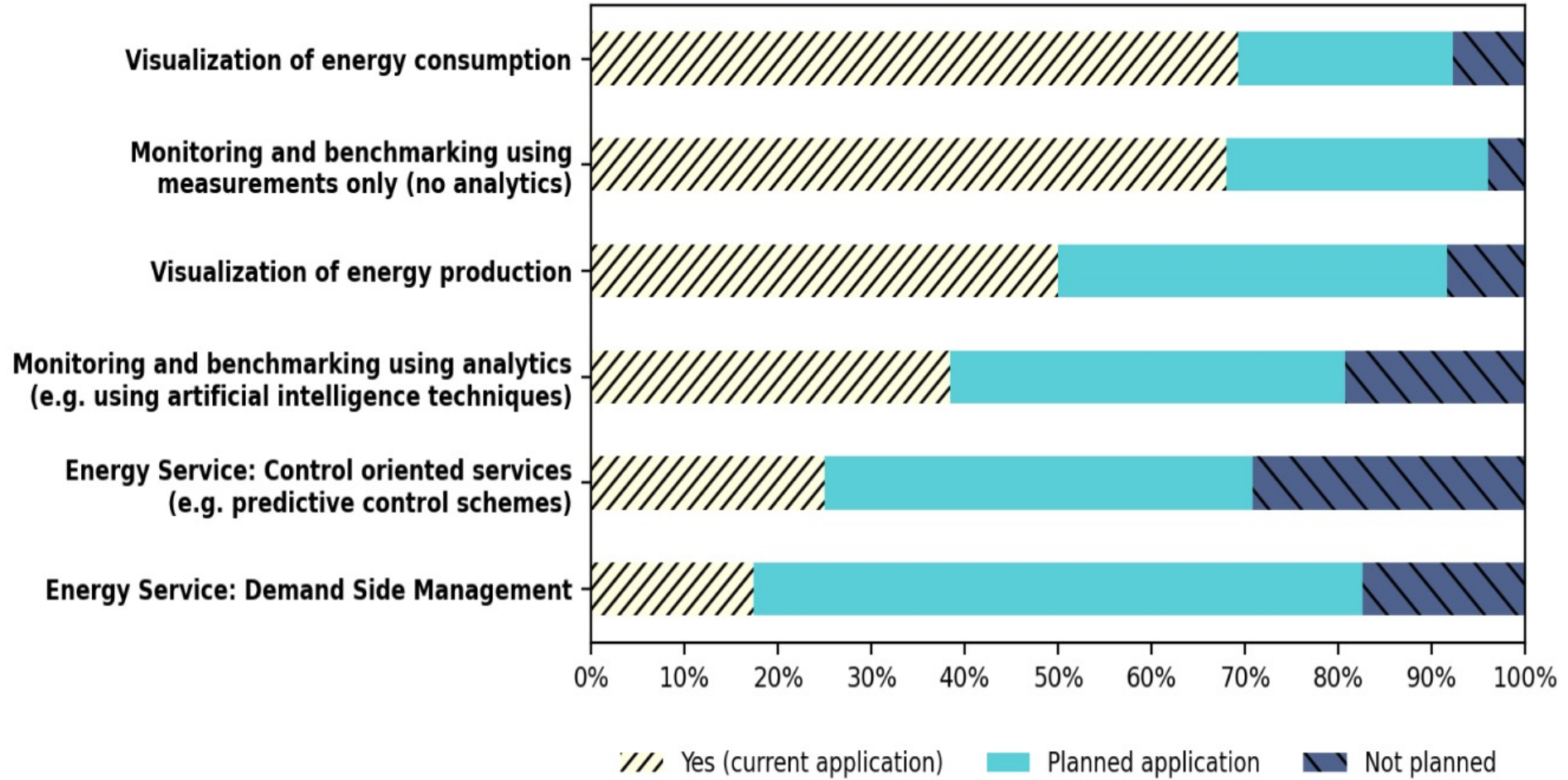
³ IEK-10, Forschungszentrum Jülich, 52428 Jülich, Germany

⁴ Center for Digital Energy Aachen, Fraunhofer FIT, 52074 Aachen, Germany

⁵ Institute for Automation of Complex Power Systems, E.ON Energy Research Center, RWTH Aachen University, 52074 Aachen, Germany

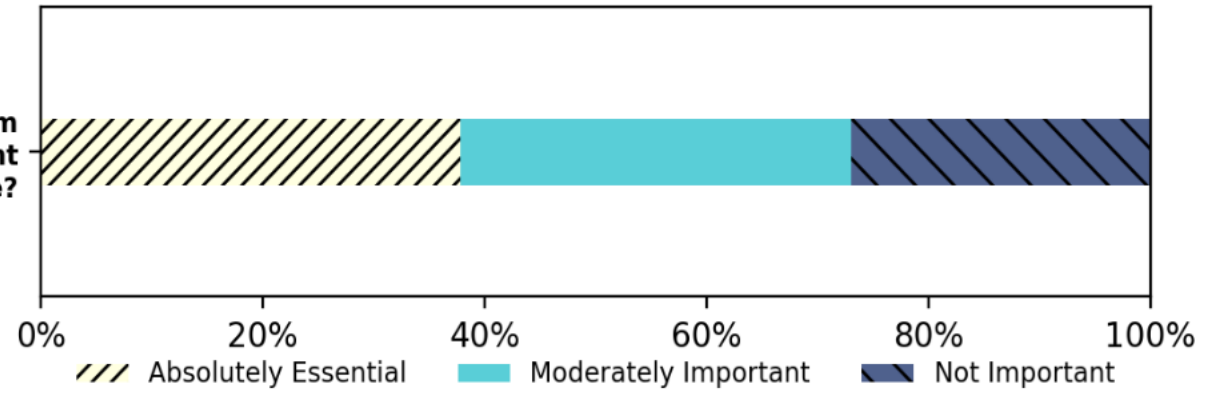
* Author to whom correspondence should be addressed.

Application for which you (plan to) use an IoT Middleware Platform

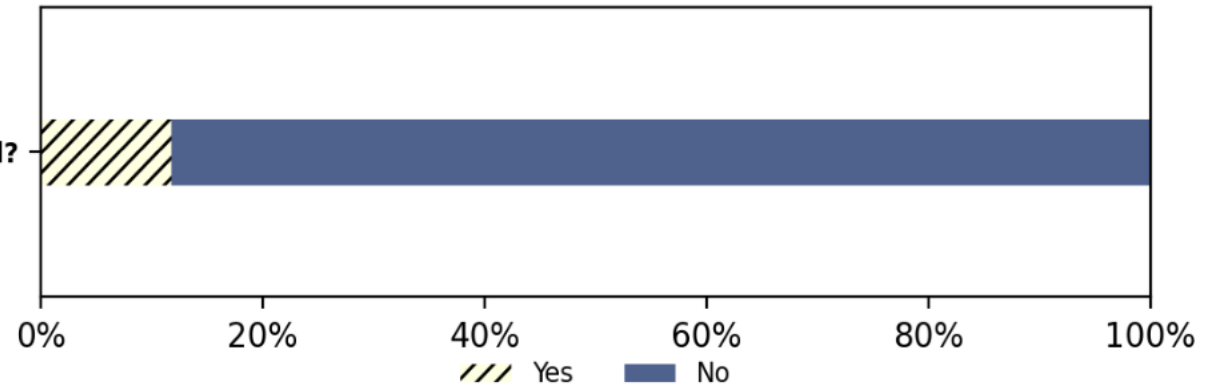


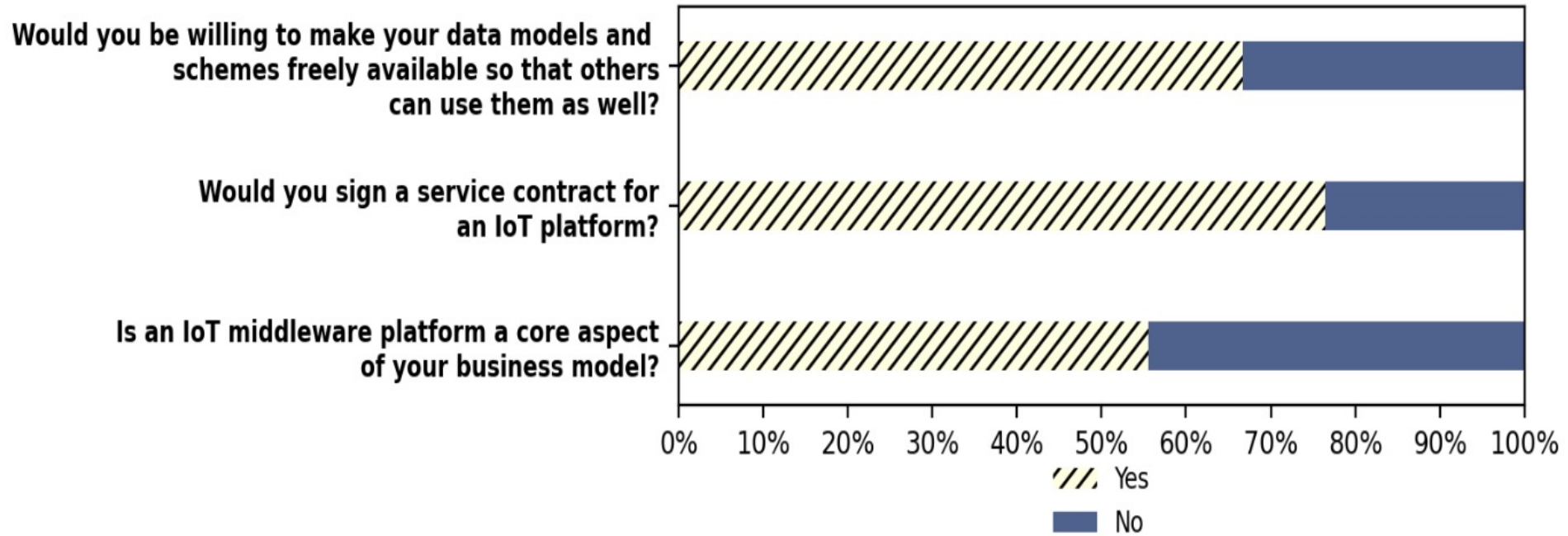
Data Model

How important do you consider uniform semantic data models and data point labelling in the future?

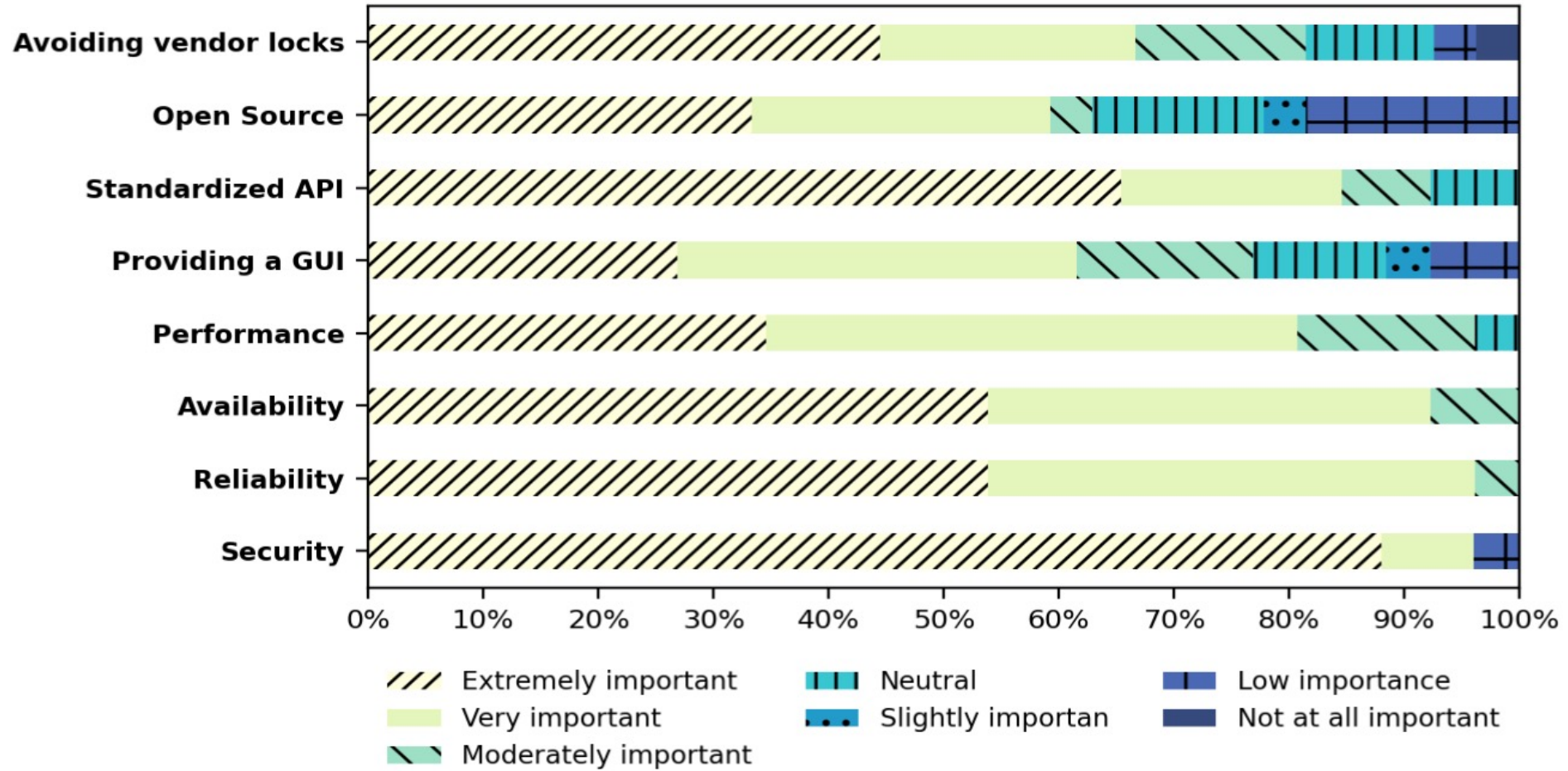


Do you already use a unified model?





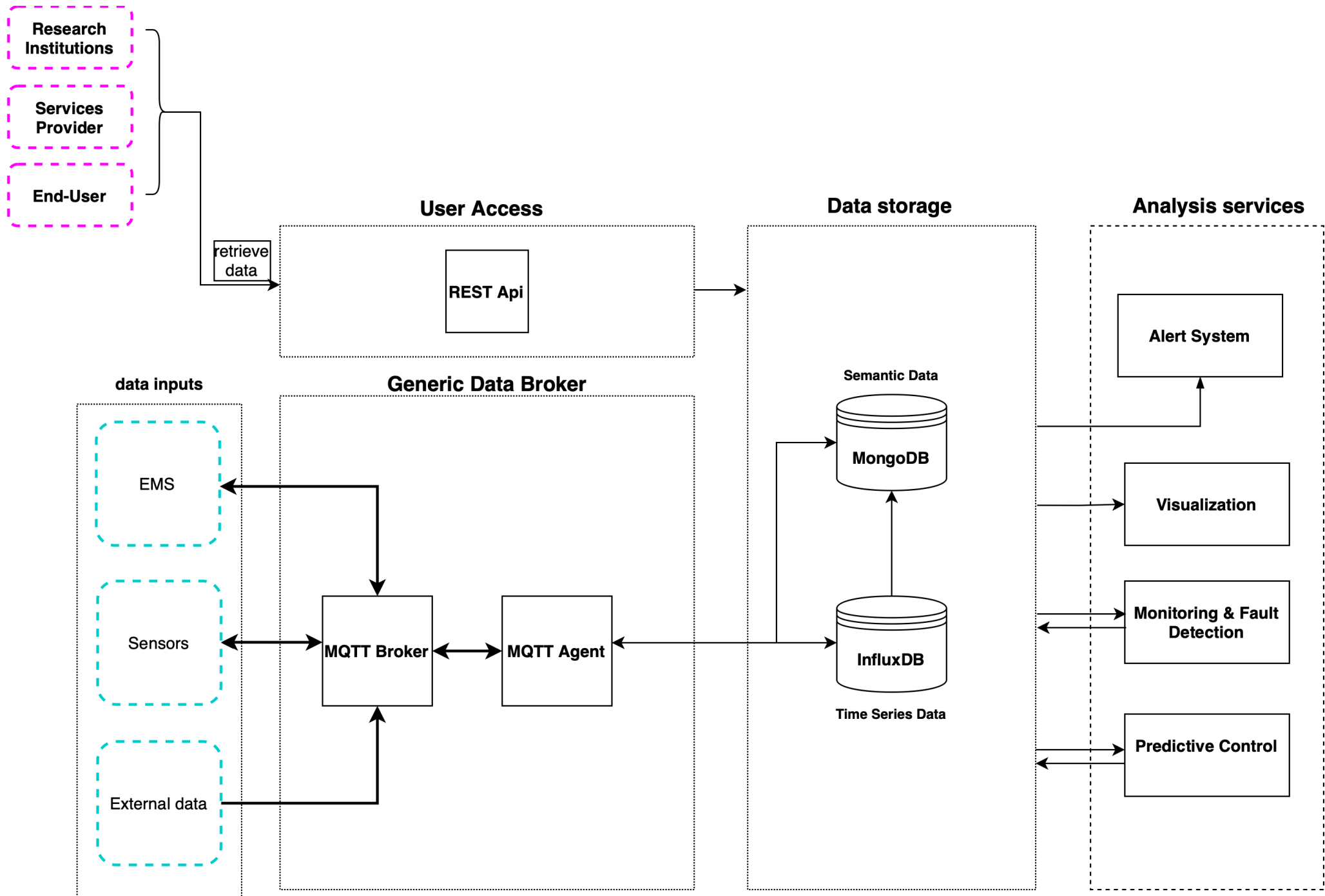
How important is the following property for you when you operate an IoT platform



[...] **Current Status**

#Inframonitor #Innovation District Inffeld





Monitoring / Diagnosis

Current Water Usage



Current Value

OK

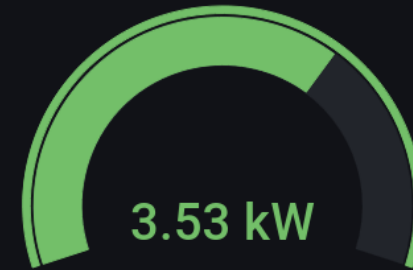
Last 3 hours

OK

Overnight value

OK

Current Energy Usage



Current value

OK

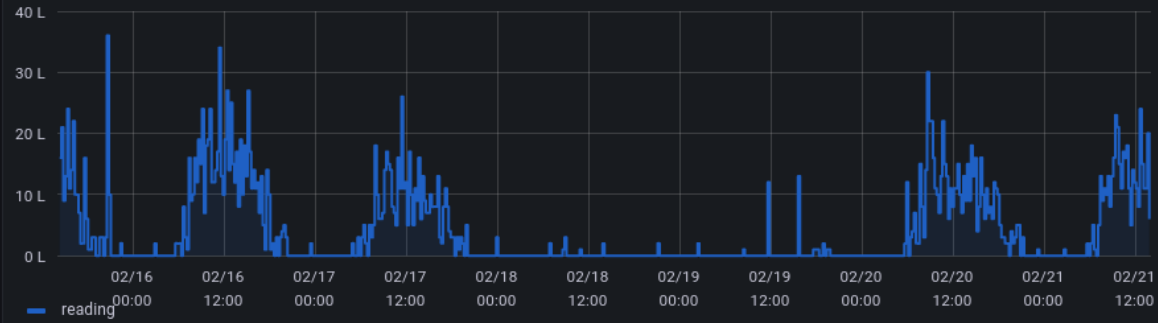
Last 3 hours

OK

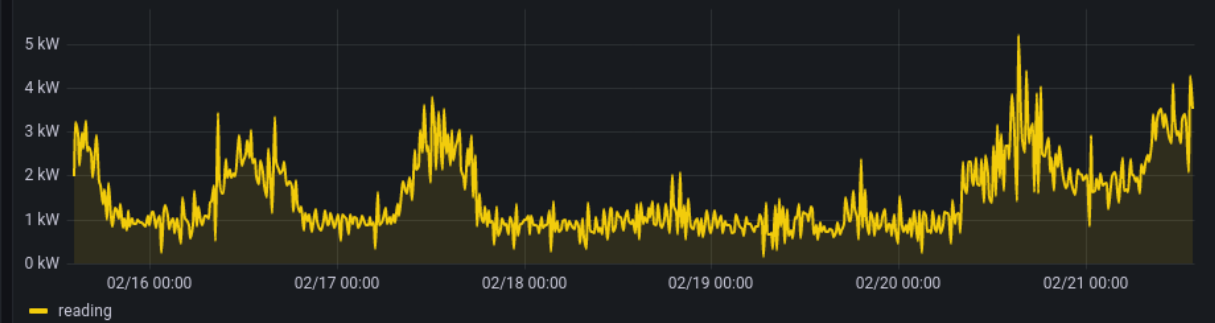
Overnight value

OK

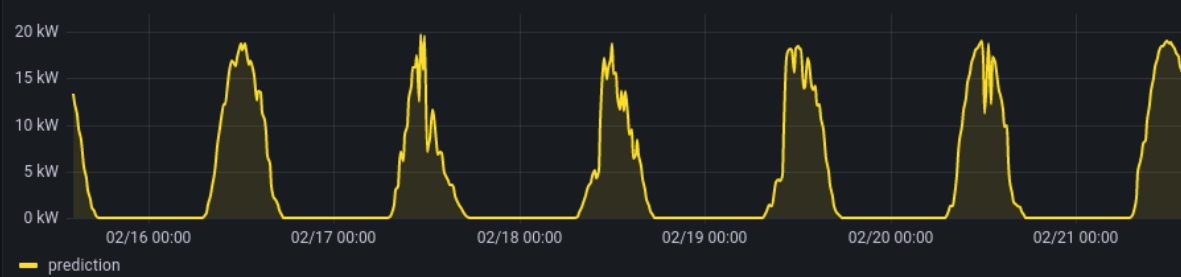
Building Water Usage



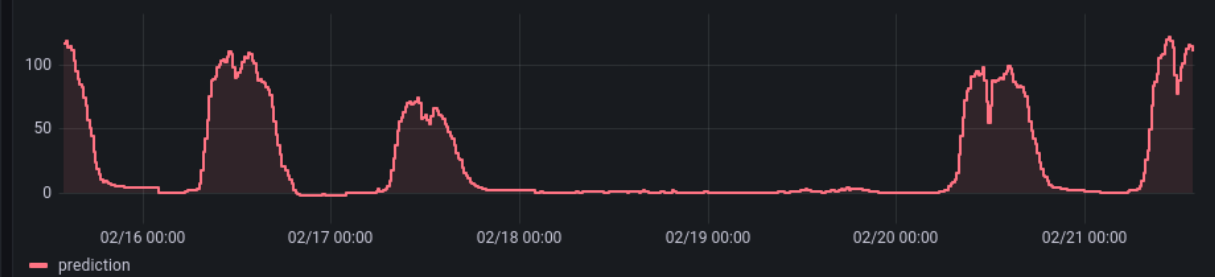
Building Energy Usage



PV Production



Occupancy



Wetterstation Inffeldgasse 13

Sunshine detect

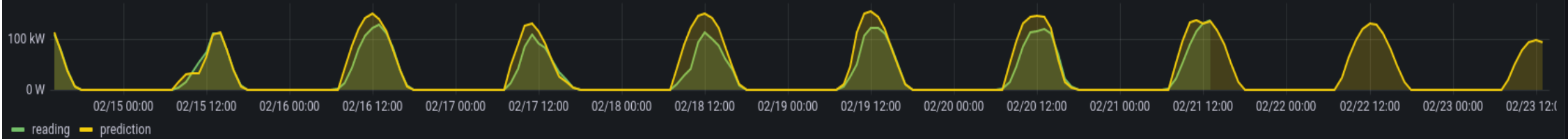


Global Irradiation Total



PV Produktion

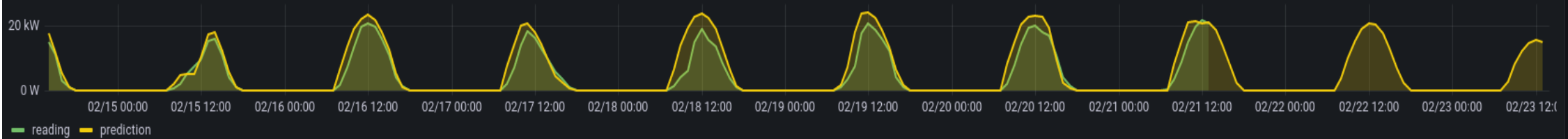
Inffeldgasse 16 AC Strom PV 400 kW Peak



Status

OK

Inffeldgasse 11 PV 60 kW Peak



Status


OK


[...] **Active User Participation**






	1	2	3	4	5
Wie angenehm empfinden Sie das Raumklima in diesem Raum derzeit?	<input checked="" type="radio"/> sehr unangenehm	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> sehr angenehm
Wie empfinden Sie die Temperatur in diesem Raum derzeit?	<input type="radio"/> sehr kalt	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> sehr warm
Wie empfinden Sie die Luftfeuchtigkeit in diesem Raum derzeit?	<input type="radio"/> sehr trocken	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> sehr schwül
Wie empfinden Sie die Luftqualität in diesem Raum derzeit?	<input checked="" type="radio"/> sehr stickig	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> sehr schwül

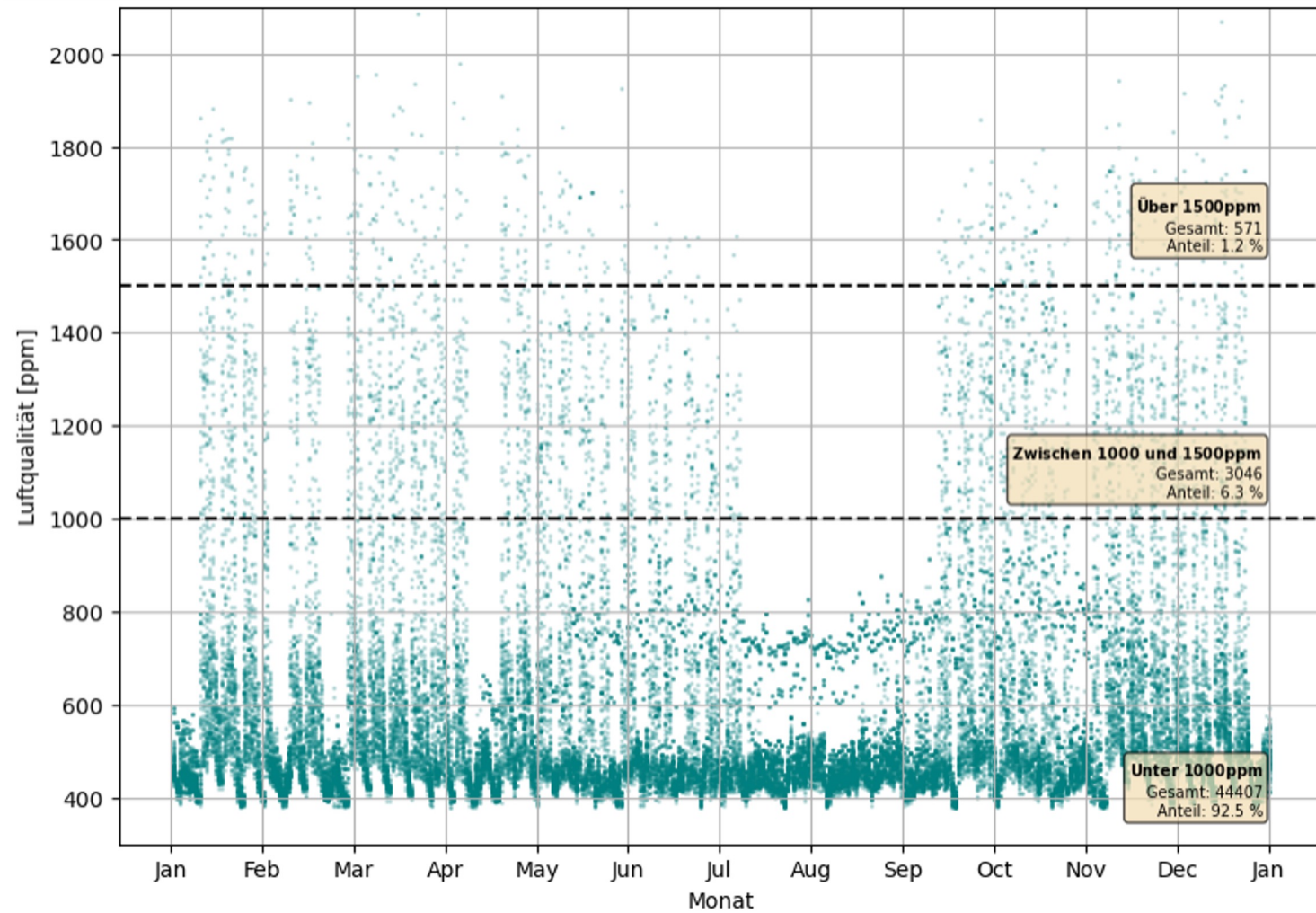
 ABBRECHEN

 ZURÜCK

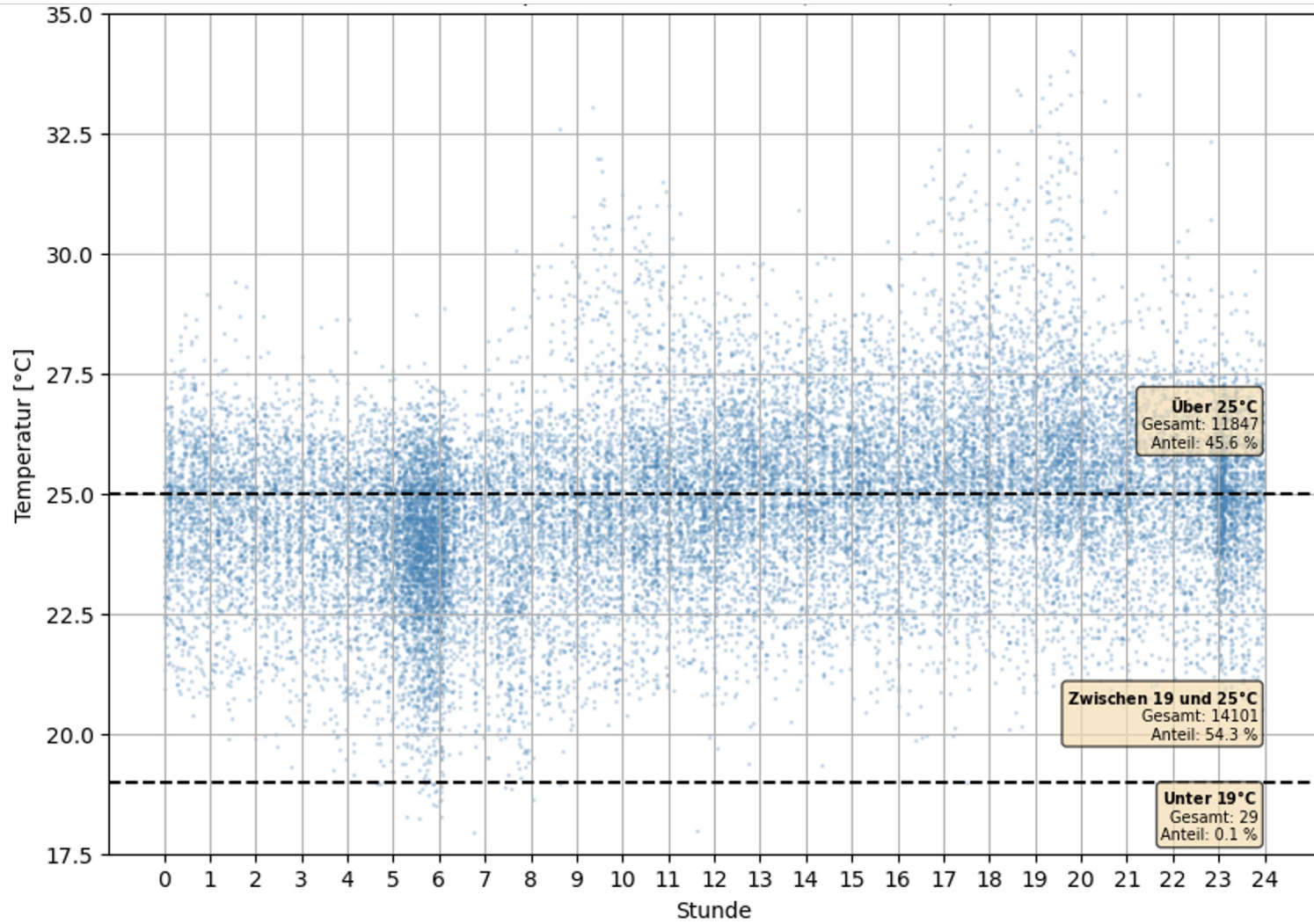
ABSENDEN 

INFO 

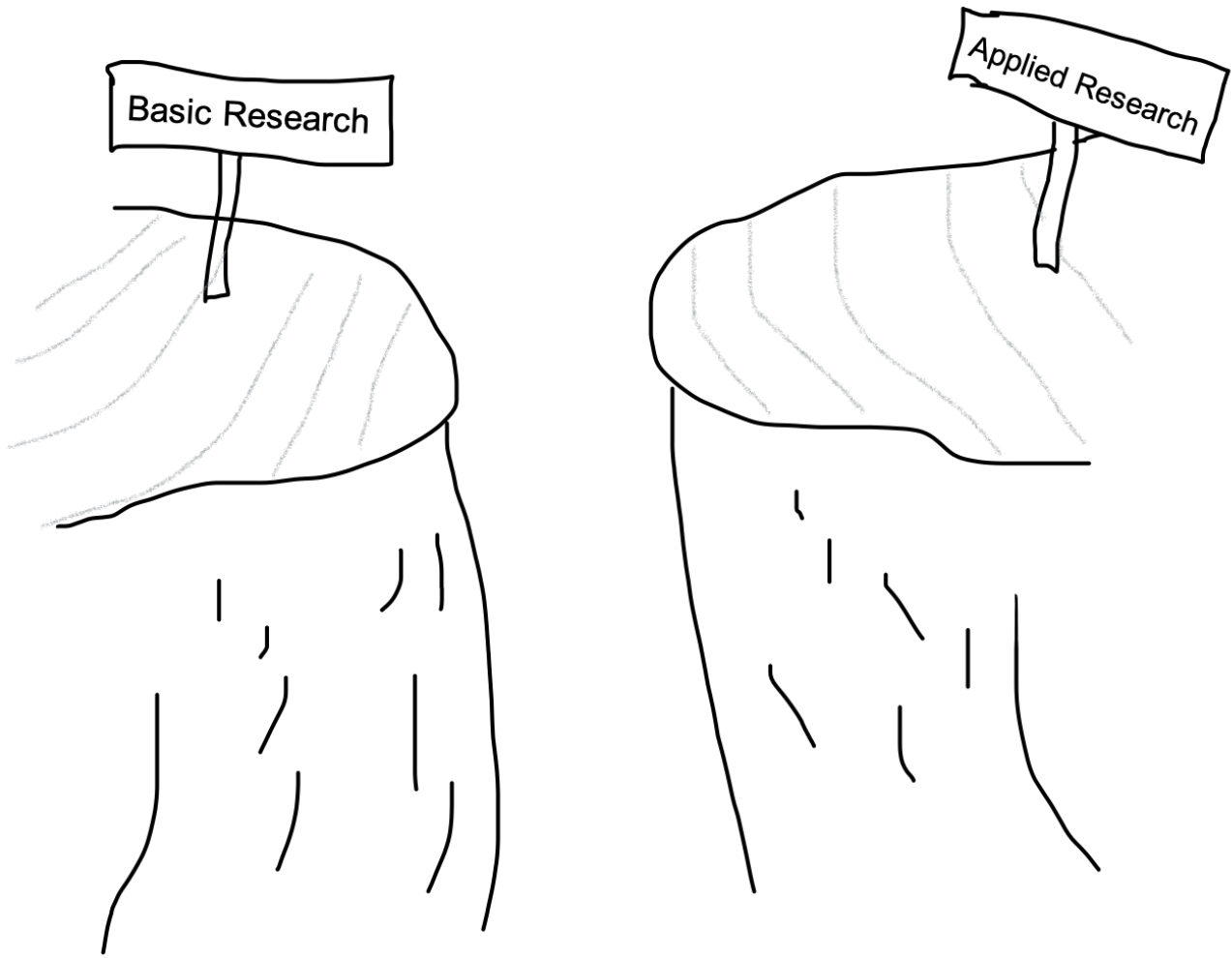
CO2-Konzentration (ppm) im Jahresverlauf



Temperatur (°C) im Tagesverlauf; Kùhlsaison



[...] Problems



- Open Data and open science
- Outside living labs: very difficult to access data
- Upgrading smartness of existing buildings

Acknowledgement

- Project User-Grids Project: <https://projekte.ffg.at/projekt/3851877>
- Project ANSERS: <https://psychologie.uni-graz.at/de/sozialpsychologie/forschung/ansers/>
- Project WhichWay: <https://projekte.ffg.at/projekt/4401800>
- Project I-Greta: <https://projekte.ffg.at/projekt/3789164>