





my%HEMS°

Learning to improve heating consumption while
learning to code



WATTx / Jolt! / 1st batch
Feb 8th, 2019





Climate
acceptable
total
budget

**2.0 t
CO₂**

My contribution to Germany's climate goal 2020

2018:
**1.10 t
CO₂**
per year per
capita
only for
heating

-13 %

target 2019:
**0.96 t
CO₂**

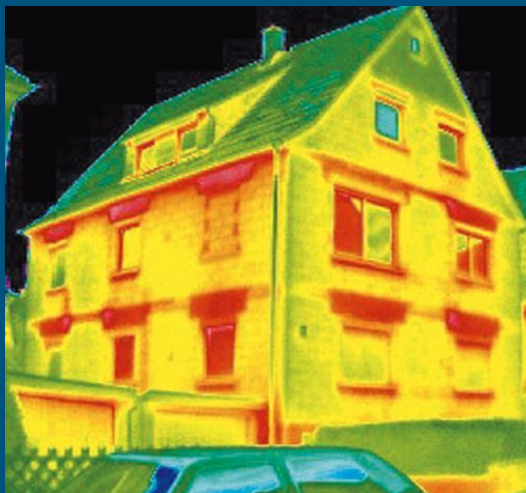
Combined heat and power plant Moabit – black coal

There are 3 ways to optimize my heating



heating system →

VATTENFALL 



building insulation →
landlord



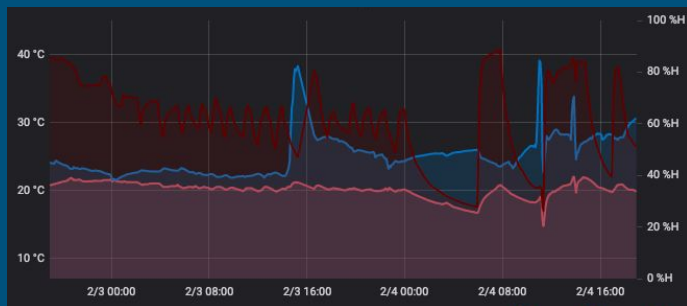
user behaviour →

my%HEMS°

my%HEMS°

my Home Energy Management System
let's me

Visualize and **monitor** my
heating consumption, ...



calculate heating
consumption, ...

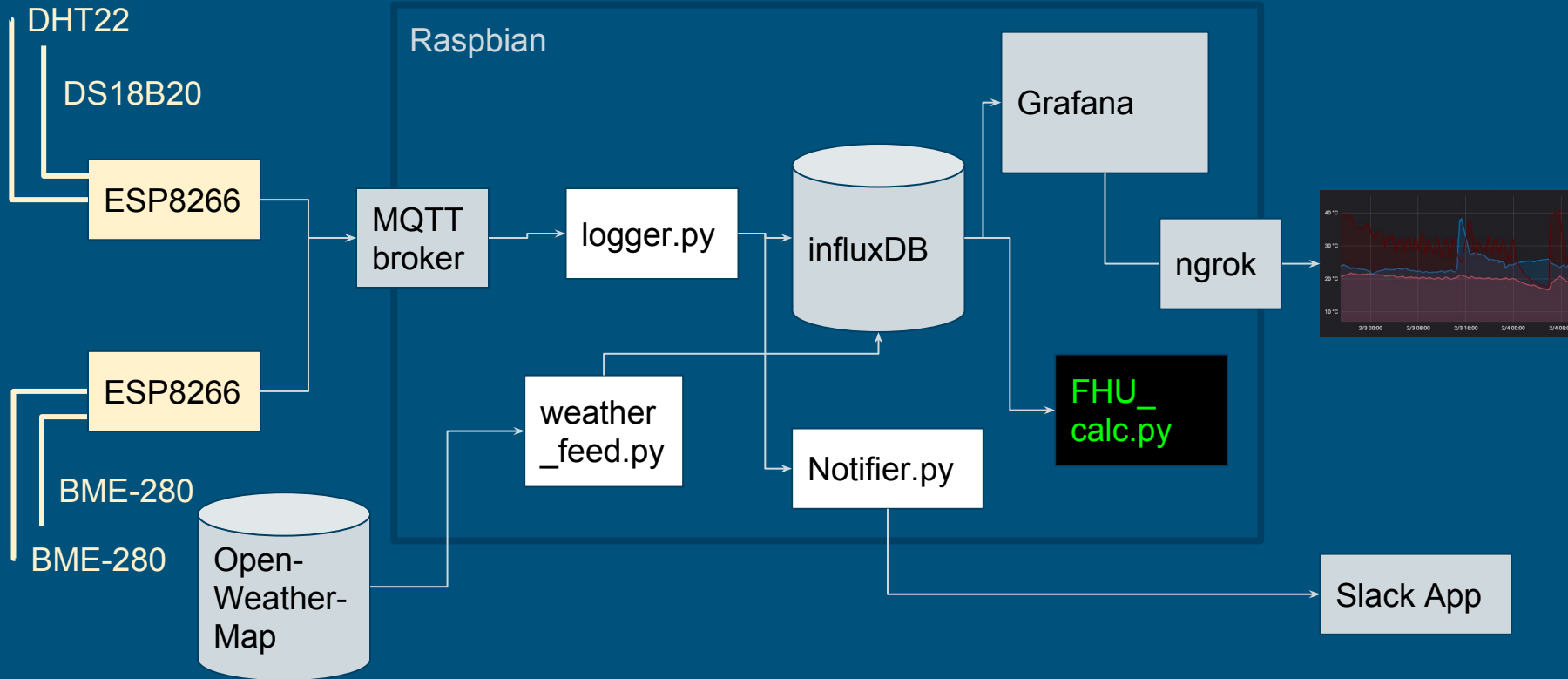
```
pi@axpi:~$ python3 /home/pi/myHEMSfiles/FHU_calc_v0.3.py
The heat usage between
2019-01-09 23:00:00 and
2019-01-10 07:45:00 has been
128890 FHU ('fictitious heat units')
pi@axpi:~$
```

make informed
decisions about
temperature settings



... in order to **minimize heating**
while **maintaining a comfortable and healthy** living environment.

System architecture



LIVING ROOM TEMPERATURE



LIVING ROOM HUMIDITY



AIR PRESSURE

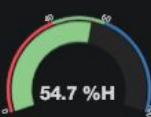
1023.6 hPa



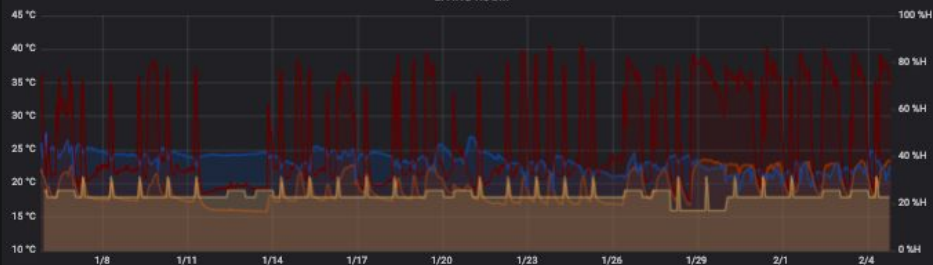
BATHROOM TEMPERATURE



BATHROOM HUMIDITY



LIVING ROOM



	min	max	avg
temperature.mean	15.88 °C	23.62 °C	19.34 °C
humidity.mean (right-y)	26 %H	50 %H	38 %H
temperature2.mean	17.42 °C	40.66 °C	27.03 °C
TRVSettings.mean	16.00 °C	21.00 °C	18.40 °C

BATHROOM



	min	max	avg
Air Temperature	11.70 °C	21.73 °C	19.27 °C
Humidity (right-y)	35 %H	81 %H	47 %H
Radiator Temperature	13.40 °C	41.61 °C	28.80 °C
TRV Setting	18.00 °C	23.00 °C	18.87 °C

TRV Settings

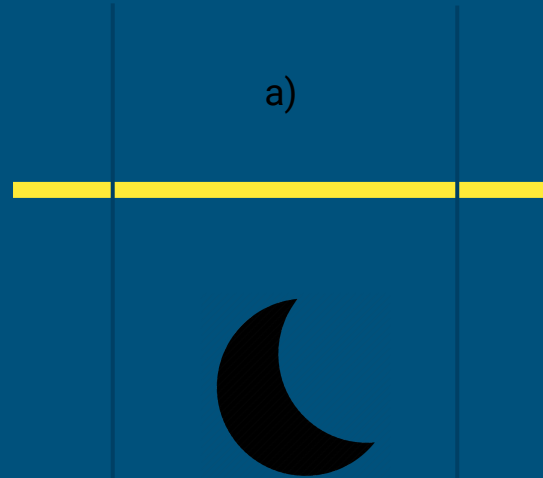


Weather

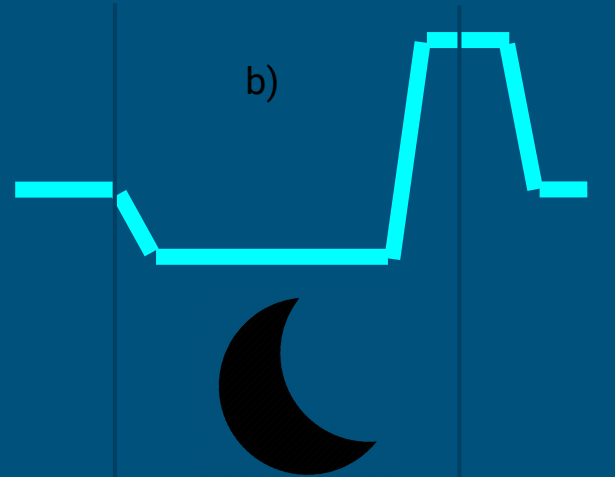


Does it consume more energy to...

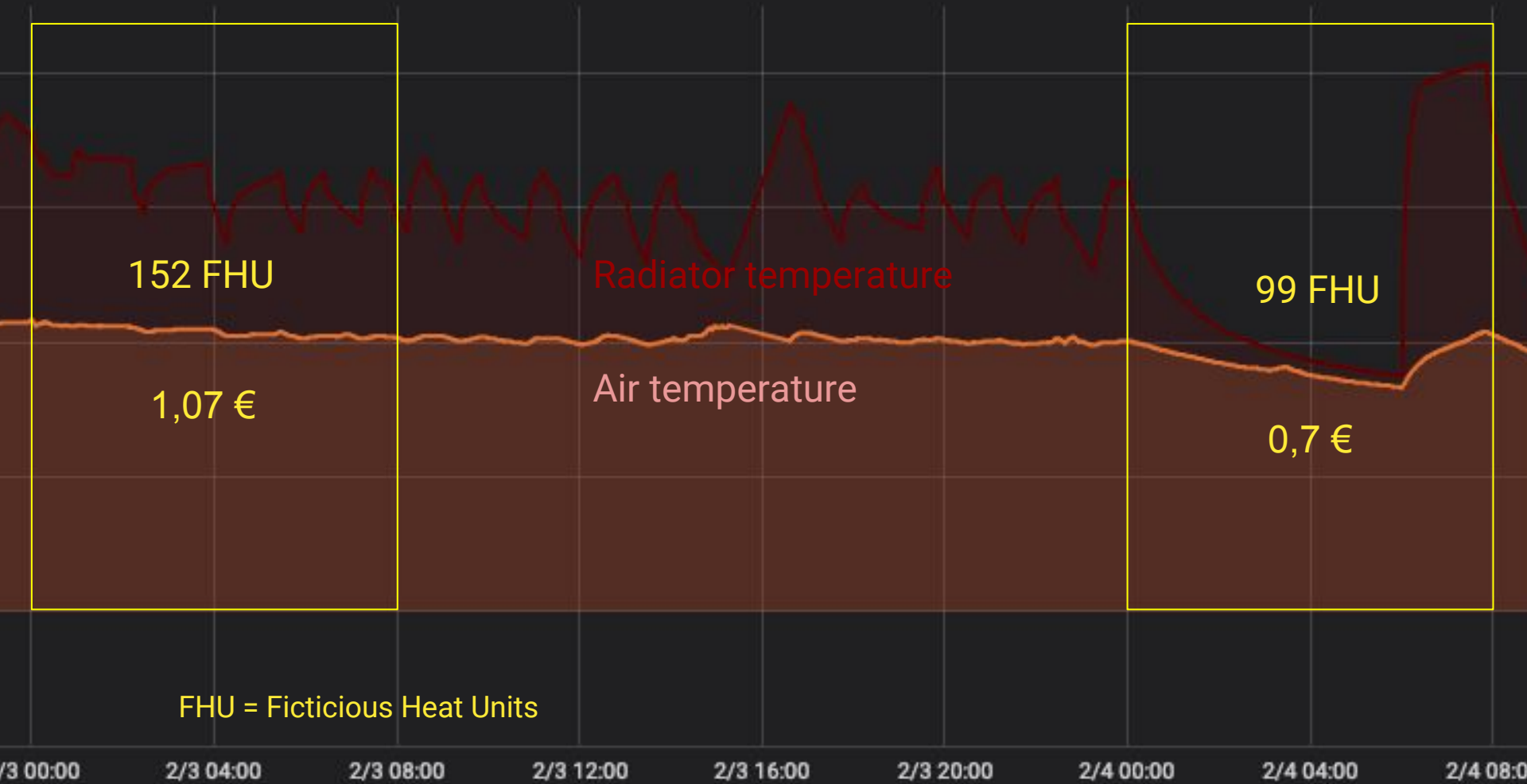
To keep a temperature level trough night...



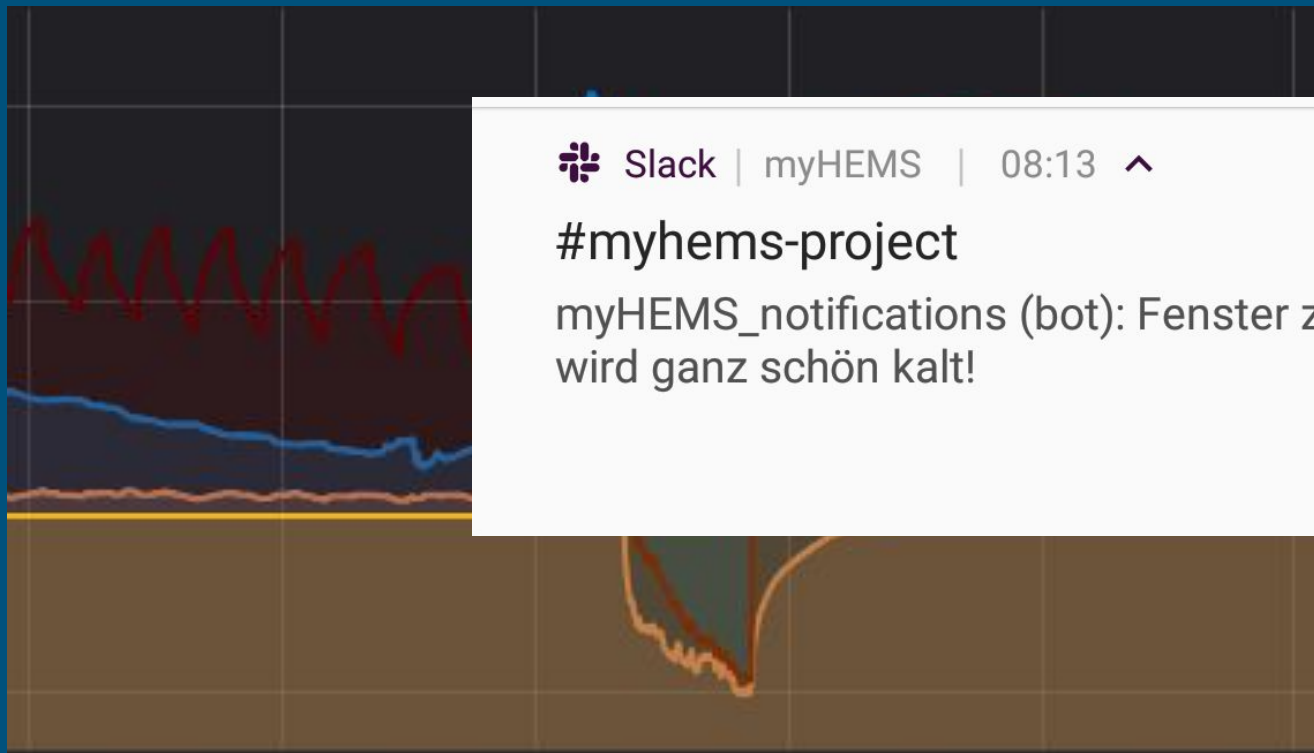
.... or to turn heating off at night and heat up in the morning?



BATHROOM



It's an enormous waste of energy when you forget to close the window



 Slack | myHEMS | 08:13 ^

#myhems-project

myHEMS_notifications (bot): Fenster zu! Es wird ganz schön kalt!



ANTWORTEN

Limitations of the calculation

- no **outside temperature** (yet)
 - no **wall temperature**
 - Measurement **accuracy**
 - Limited quantity of **data**
 - Fictitious Heat Units is an **approximation**
-
- **Every flat is different!**

What comes next?

- Better notifications
- More sensors
- Remote controlled TRVs
- Geo-location

→ “Predictive heating”

What could a product be?



My learning path continues

Before Jolt



“Wie der Ochs vorm Berg”

After Jolt



“limitless ocean of possibilities”

What comes after Jolt for me?

Jolt did NOT scare me away from
the tech space – **on the contrary! :-)**



Thank you!

WATTx, for creating this opportunity and providing Jolt as a sandbox.

My mentor, for opening the doors and setting me on the right path.

My wife, for her invaluable feedback and for keeping me alive during the project period.



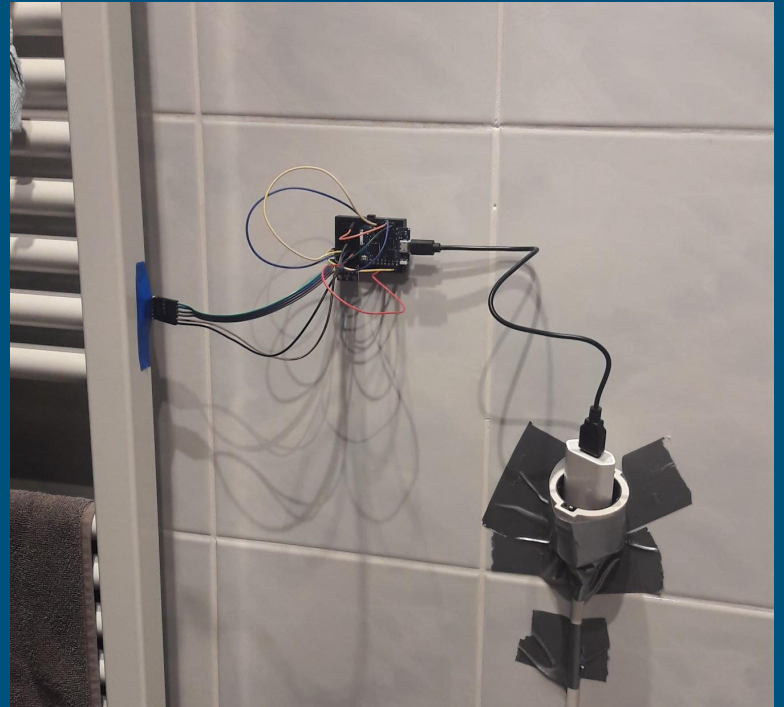
x@rogueleaders.de



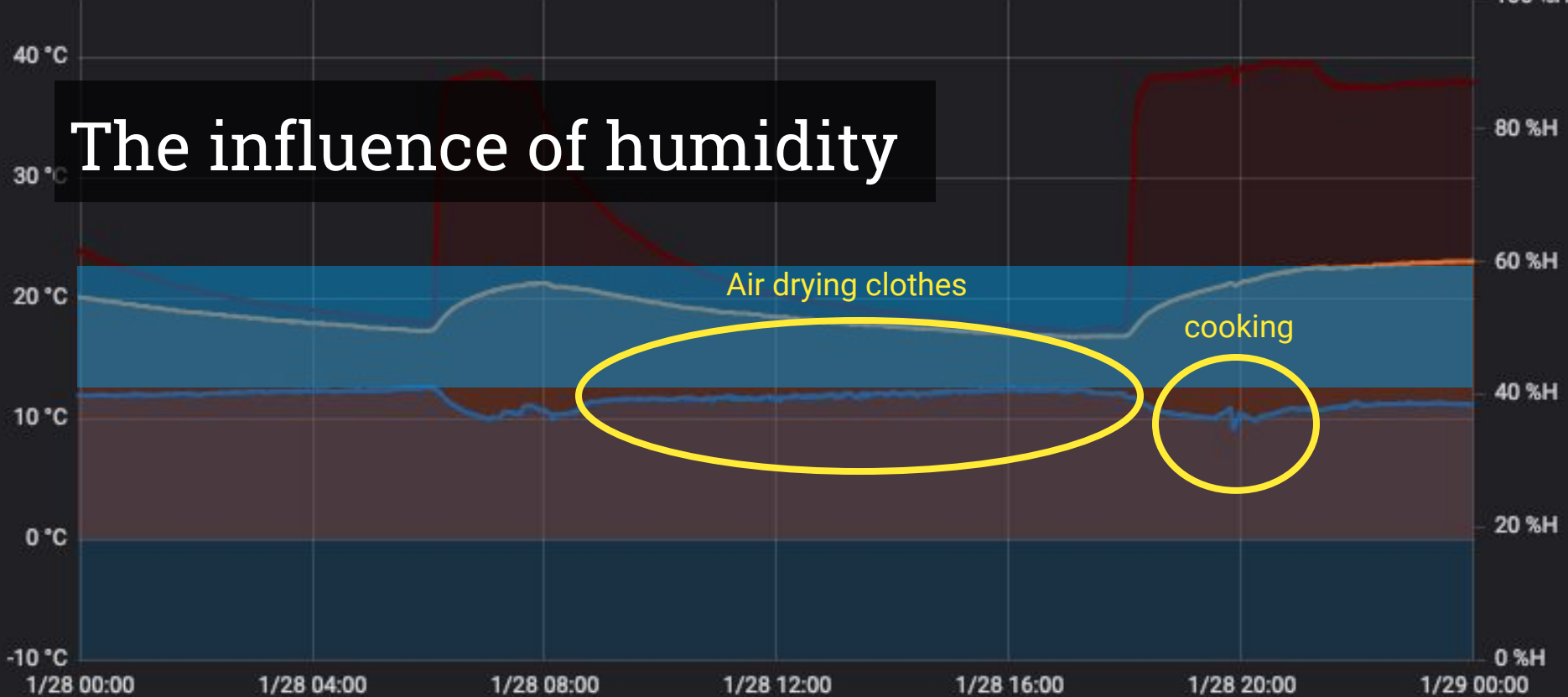
github.com/elllo/

Back-up

Hardware



The influence of humidity



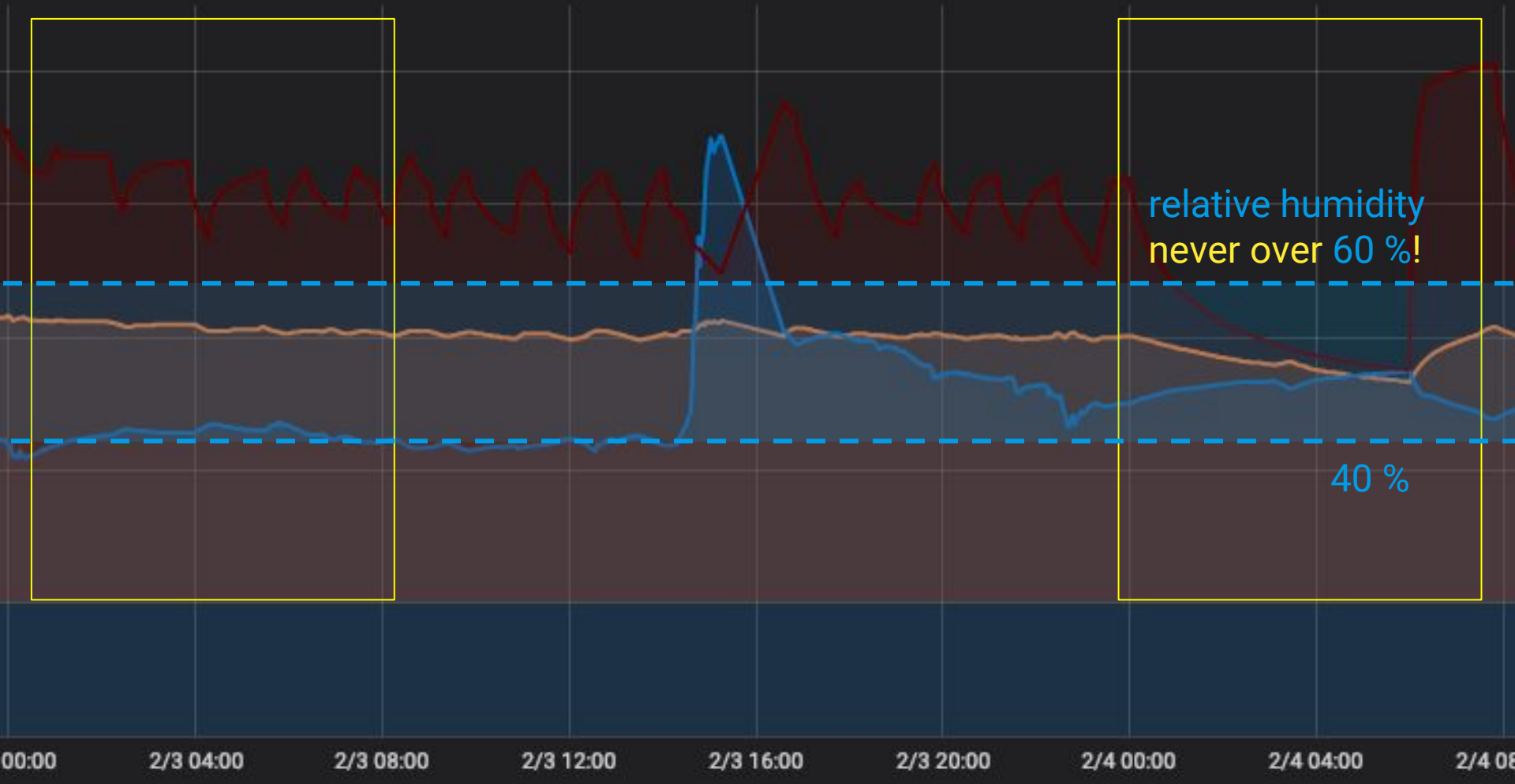
— Air Temperature

— Humidity (right-y)

— Radiator Temperature

	min	max	avg
Air Temperature	16.73 °C	23.10 °C	19.29 °C
Humidity (right-y)	35 %H	41 %H	39 %H
Radiator Temperature	17.20 °C	39.70 °C	26.24 °C

BATHROOM

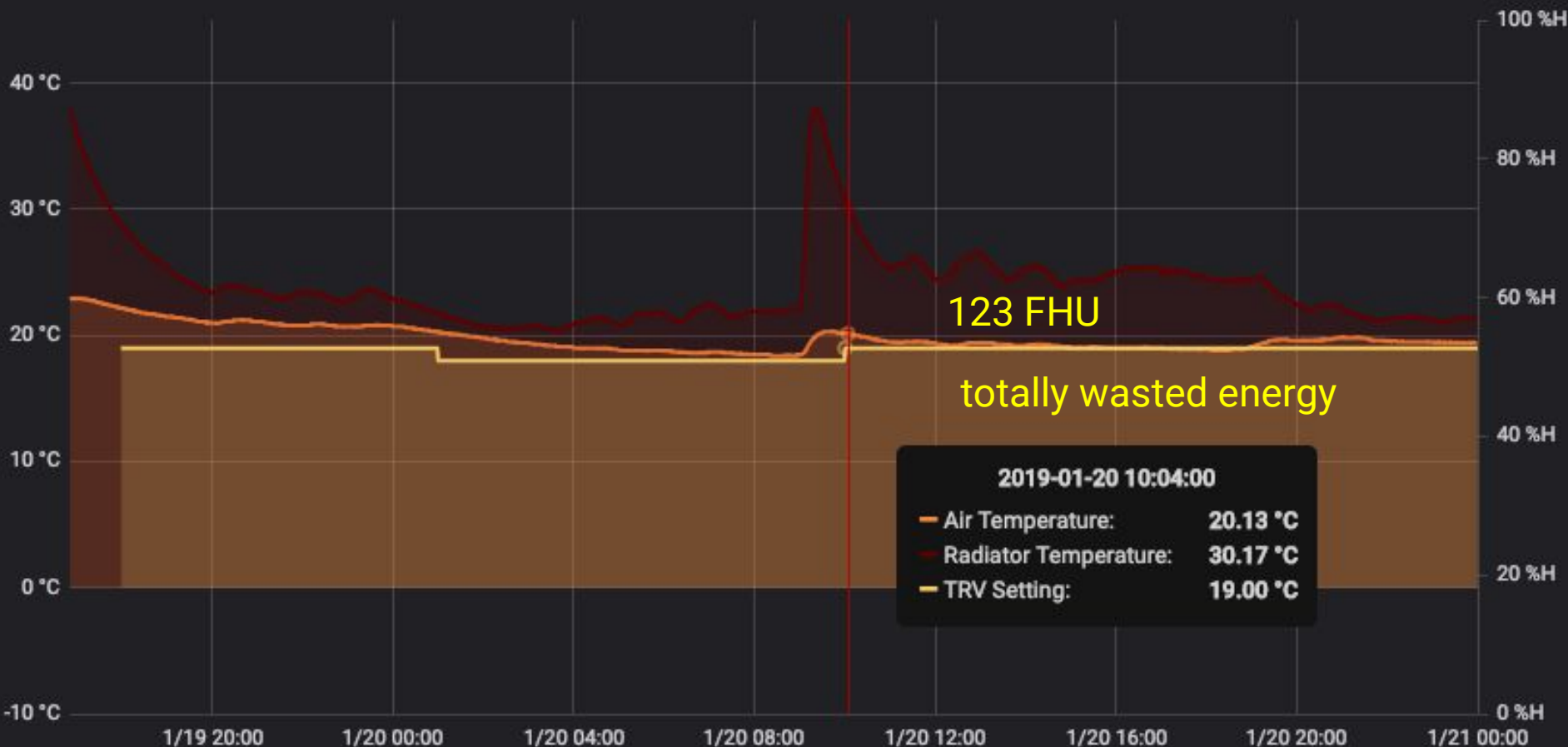


WATTx Office at around 33 % r. H.

(2019-12-11 15:00:00)



LIVING ROOM ▾



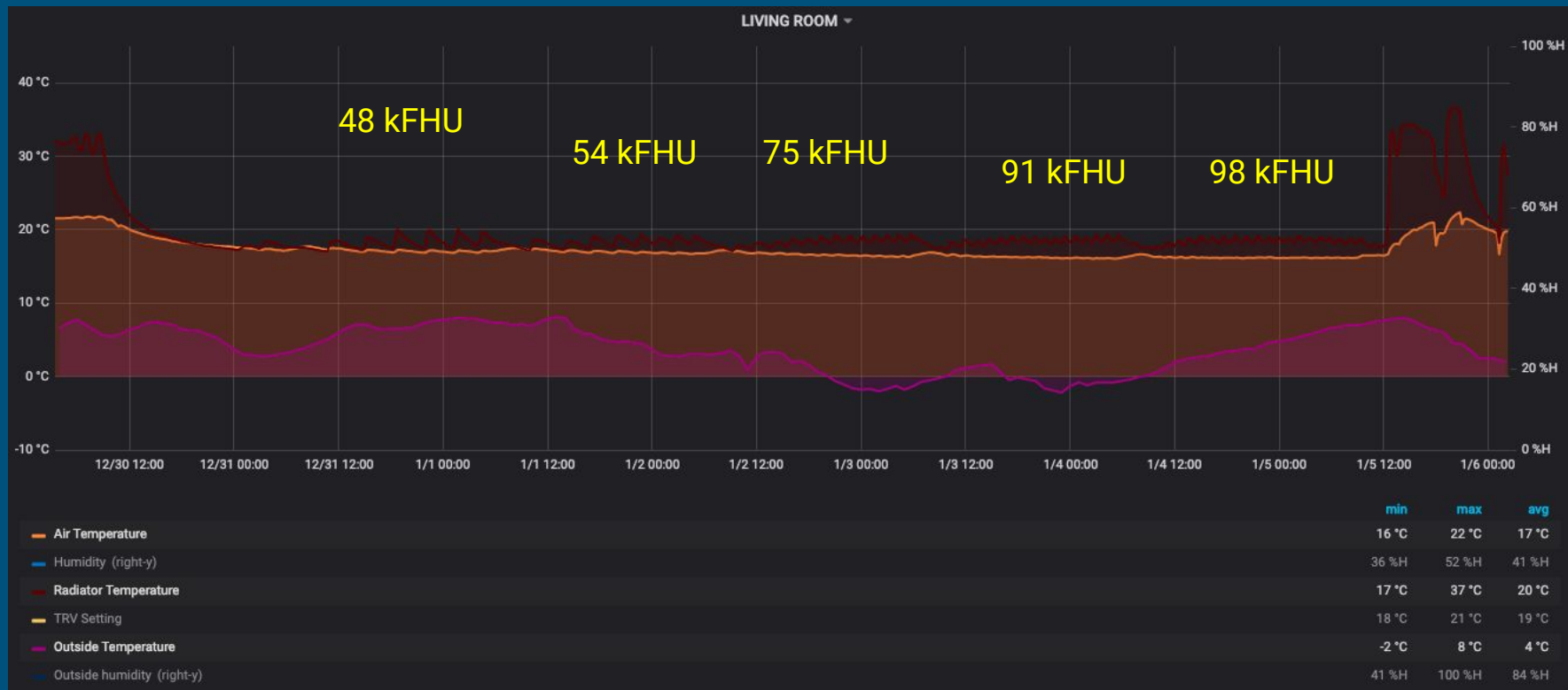
123 FHU

totally wasted energy

2019-01-20 10:04:00

Air Temperature:	20.13 °C
Radiator Temperature:	30.17 °C
TRV Setting:	19.00 °C

vacation



It's difficult to take measurements under real life conditions...



My Jolt “tech” learnings

Python, MQTT, JSON, influxDB, DDL/DML, Arduino, APIs, webhook, try/except, UNIX timestamp, datetime conversion, data conversion, type conversion (parsing), generator object type, program efficiency, reading and writing to a file, VPN/DynDNS, Grafana, sensor types, experimentation under real life conditions, reading documentation properly, python style guide, code readability, code reuseability, GitHub, ngrok, Raspberry Pi, Command line, SSH, Screen...