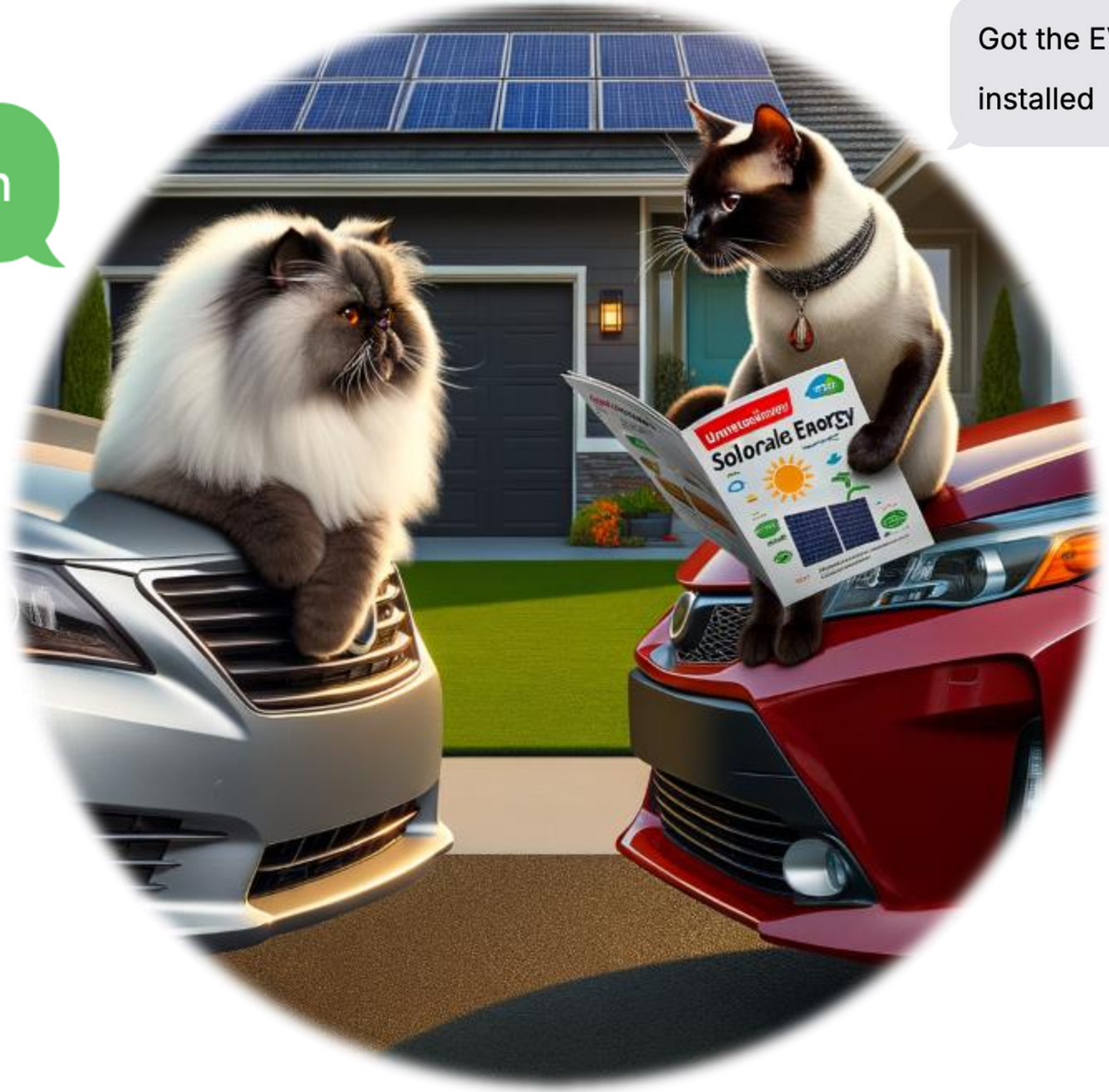
Ho Ho Home Automation

Story of how power monitoring opened another world.

Got the EV charger installed

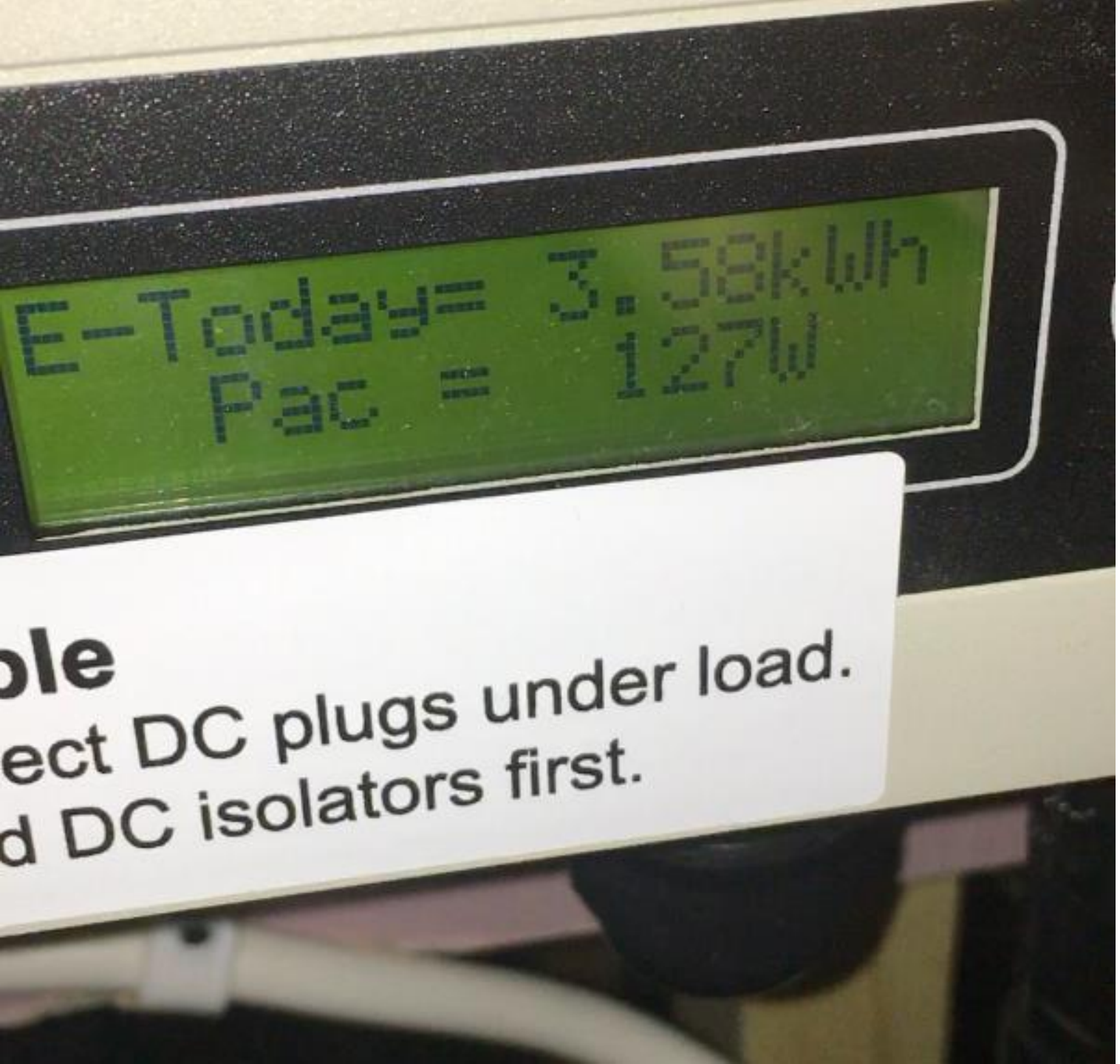
Aggh

sparks had a good laugh at the solar array. It's useless since its north facing



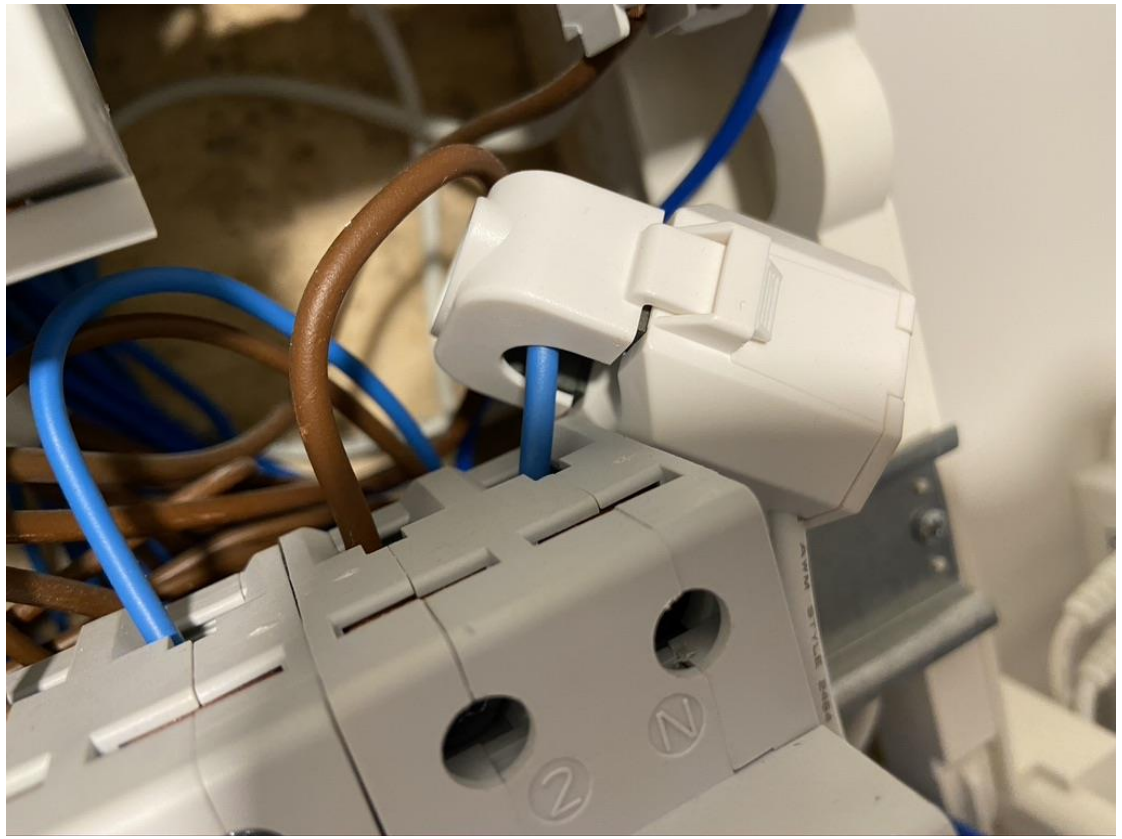
August 2019


South
North

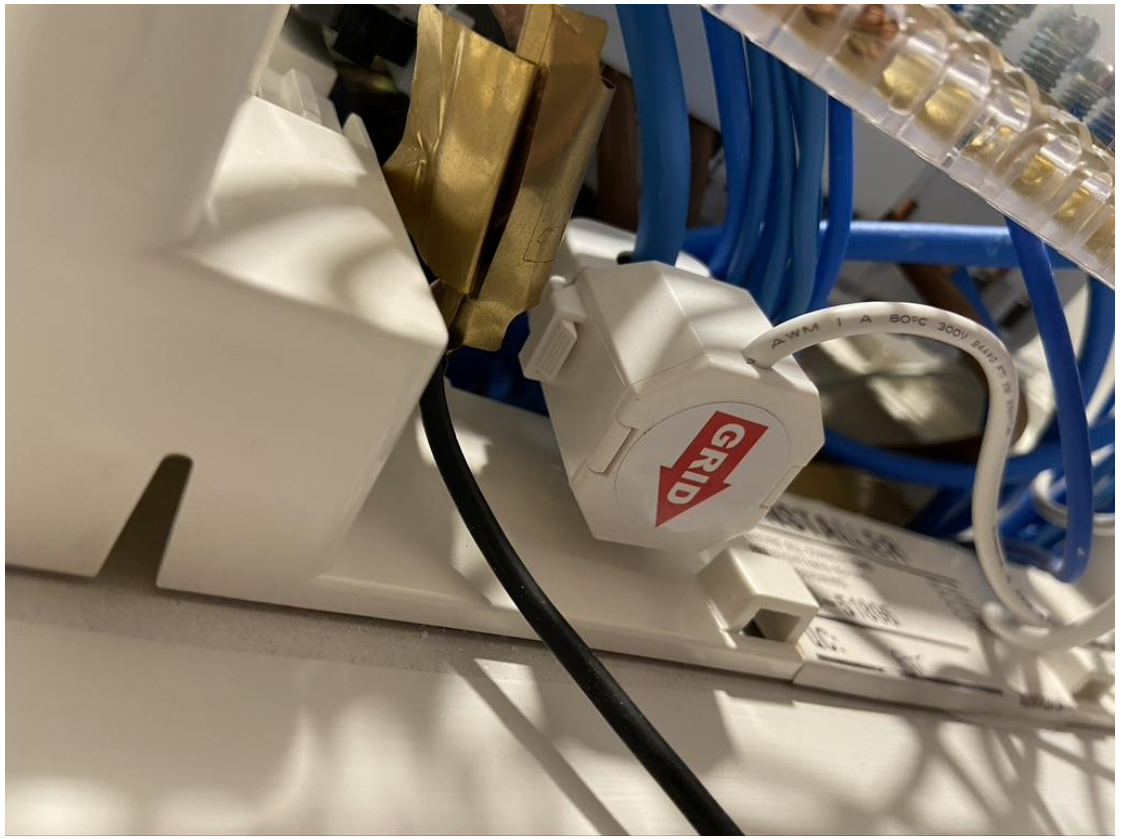


Sunny day in August 2019 @ 19:39

- Energy monitor that also monitors PV
- Battery operated

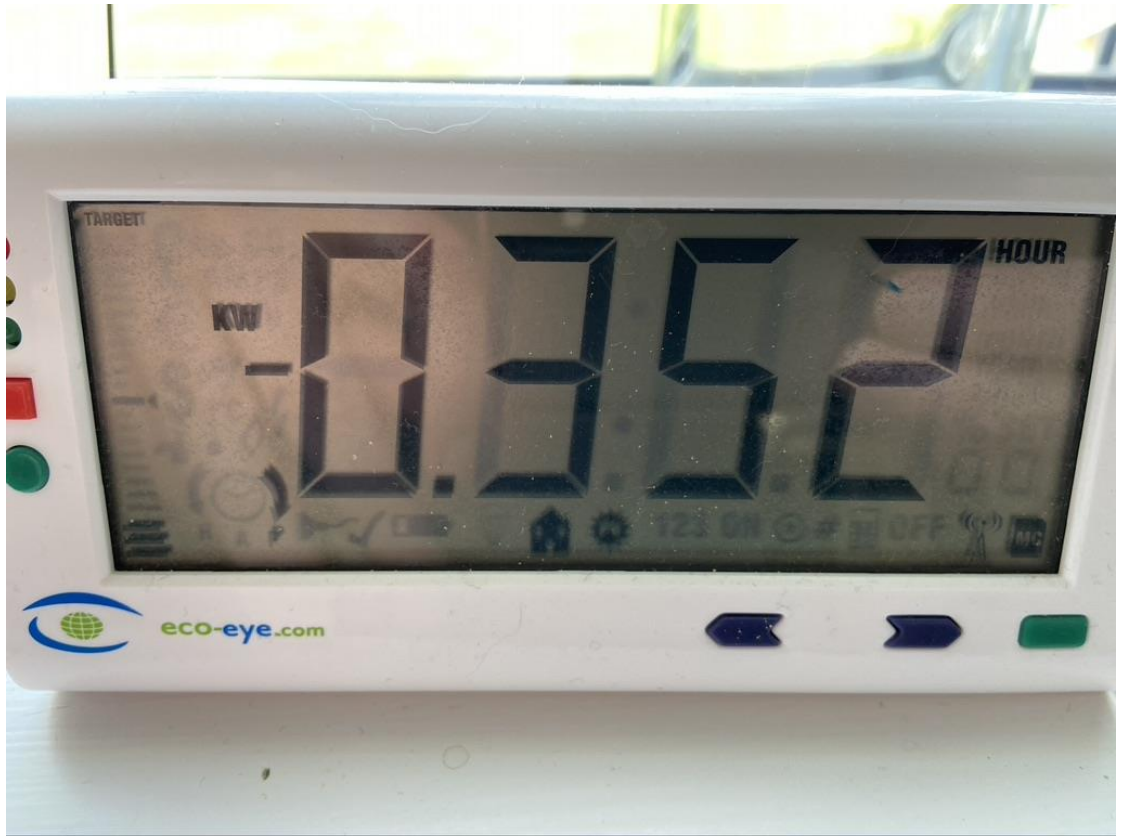


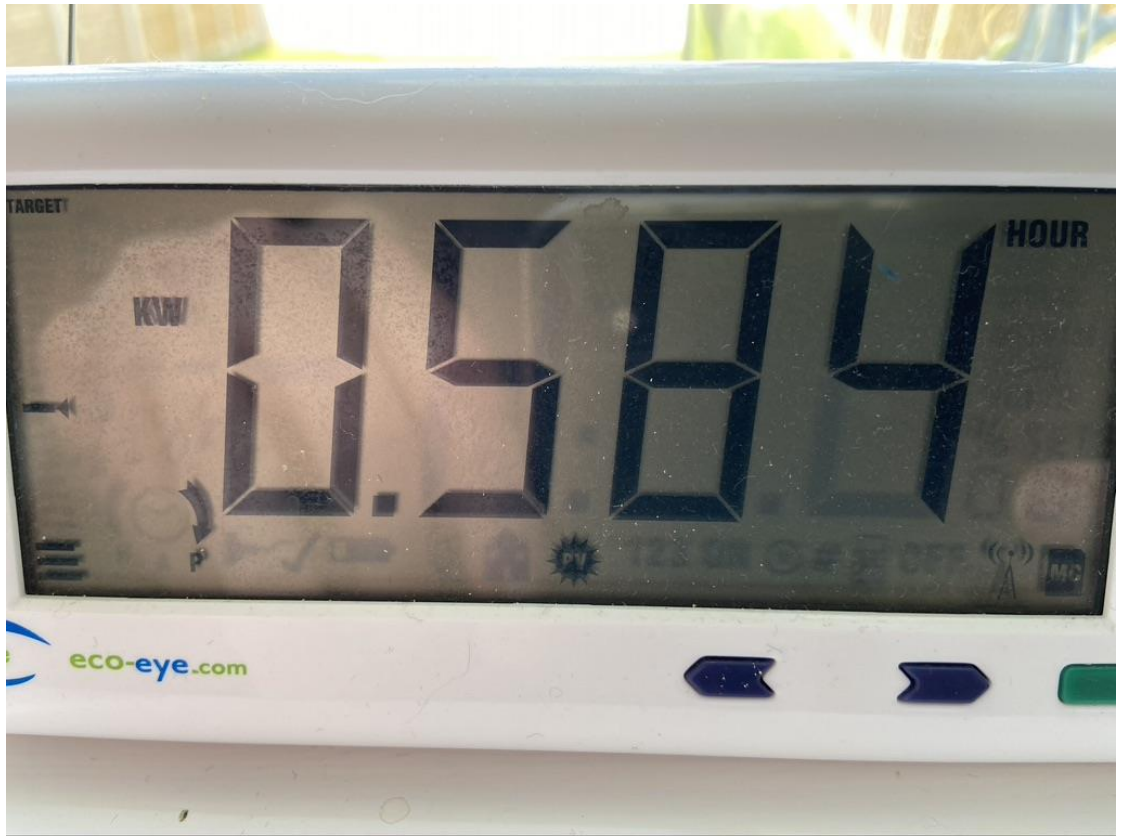
CT Sensor solar RCBO



CT + voltage sensor grid mains

28th April 2020

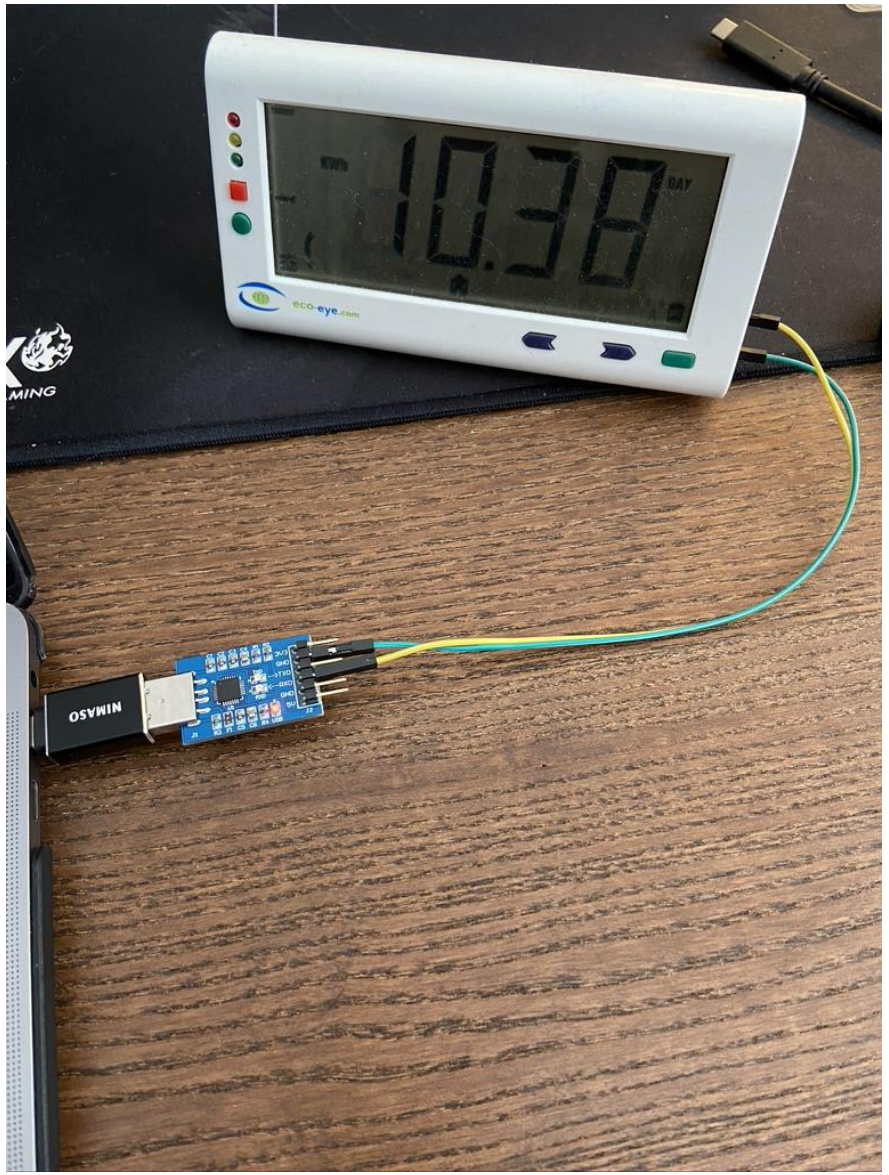


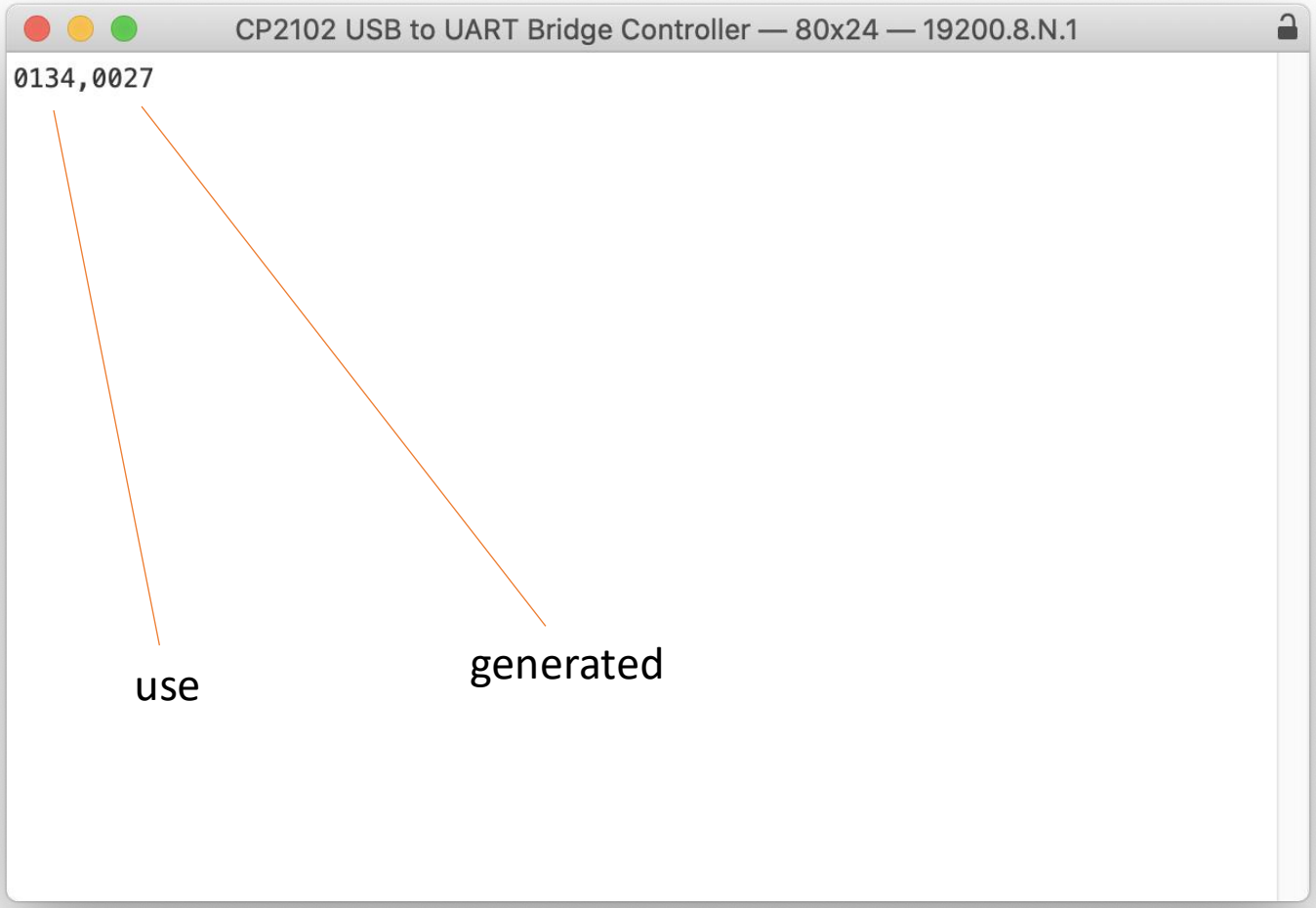


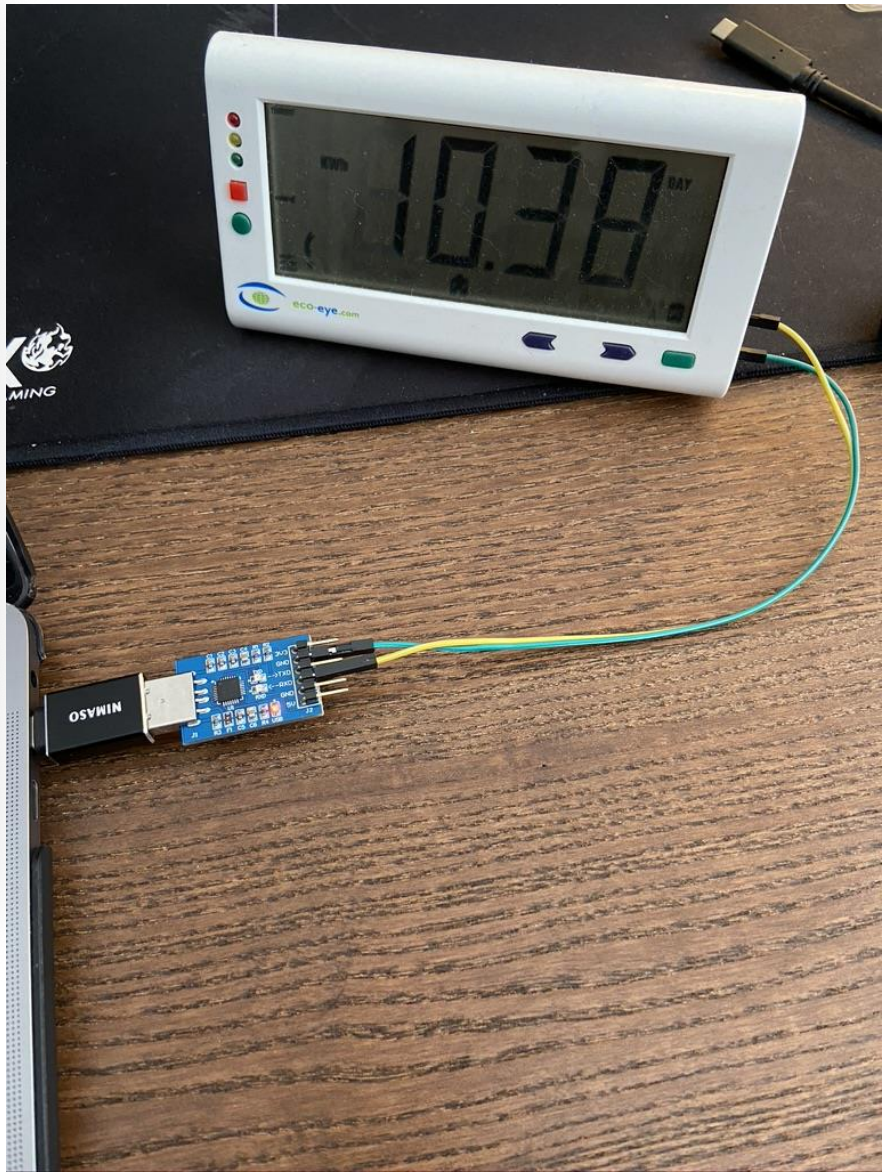
Start looking at serial ports

CP2102 USB to UART Bridge Controller — 80x24 — 19200.8.N.1

```
0134,0027
```







For SmartPV, every 4 seconds there will be the following terminated by carriage return(0x0d):
uuuu,gggg

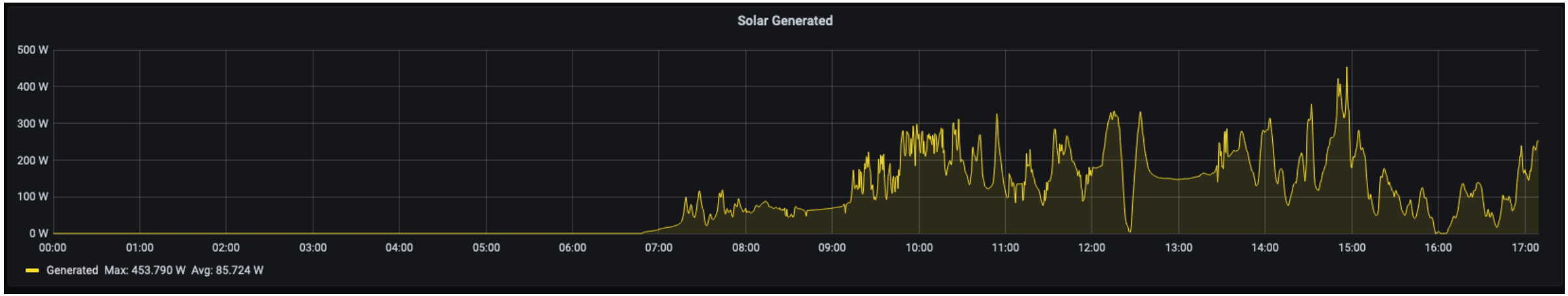
Where uuuu is the used reading in amps *100 and gggg is the generated reading in amps *100

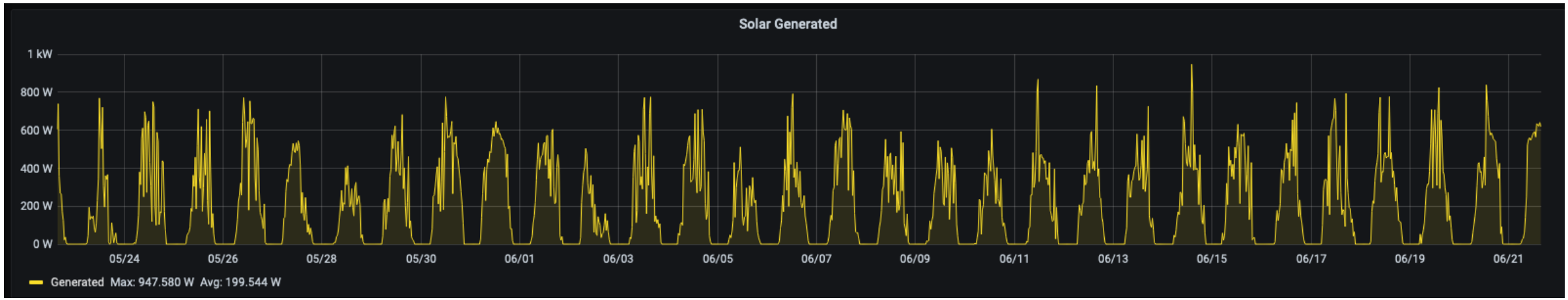
- Enabled UART
- Just two pins needed:
  - Ground
  - RX (GPIO 15)

Node-RED

influxdb

Grafana


Solar Generated
500 W
400 W
300 W
200 W
100 W
0 W
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
08:00
09:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
Generated Max: 453.790 W Avg: 85.724 W


Solar Generated
1 kW
800 W
600 W
400 W
200 W
0 W
05/24
05/26
05/28
05/30
06/01
06/03
06/05
06/07
06/09
06/11
06/13
06/15
06/17
06/19
06/21
Generated Max: 947.580 W Avg: 199.544 W

24 hour

Home Dual+

- **Advanced electricity insights**
- 8.5% online exclusive discount on electricity and gas unit rates
- Paperless billing

Electricity unit price	19.90c per kWh
Gas unit price	5.391c per kWh
Estimated annual bill	€1,731

EAB based on urban 24-hour meter with unit rate discount of 8.5% and excludes welcome bonus

Full pricing information

Choose This Plan

Free weekend day

Home Dual+ Weekender

- **Free electricity on Saturdays or Sundays**
- **Advanced electricity insights**
- 8.5% online exclusive discount on electricity and gas unit rates
- Paperless billing

Electricity unit price	21.84c per kWh
Gas unit price	5.391c per kWh

Full pricing information

Choose This Plan

Day/Night

Home Dual+ Night Boost

- **Super low electricity rates at night**
- **Advanced electricity insights**
- 8.5% online exclusive discount on electricity and gas unit rates
- Paperless billing

Electricity unit price	
Day: 08.00 - 23.00	22.16c per kWh
Night: 23.00 - 08.00	11.41c per kWh
Night Boost: 02:00 - 04:00	6.16c per kWh
Gas unit price	5.391c per kWh

Full pricing information

Choose This Plan

Time of use

Home Dual+ SST

KWh Cost 0.2216 | Feed in rate 0.065 | interval 10s

Yesterdays Values

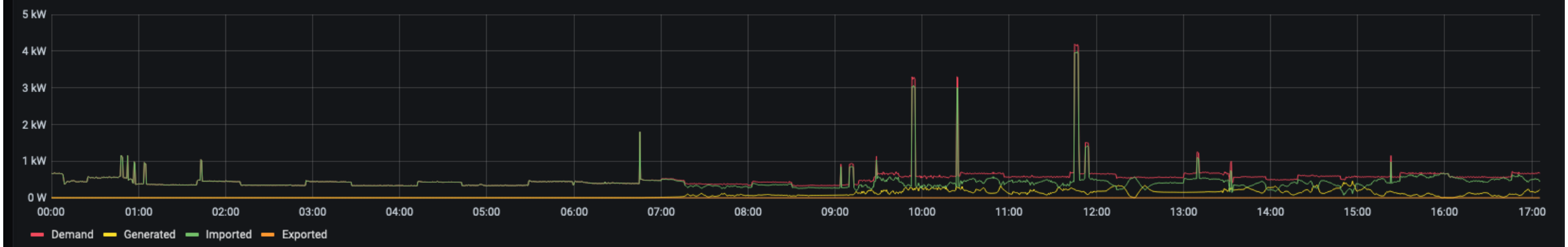
Demand	Imported	Generated	Exported
14.540 kWh	12.741 kWh	1.799 kWh	0 kWh

Cost Value	Import Cost	Savings Cost	Feed-in reward
€3.22	€2.82	€0.40	€0

Current

Demand selected period	Without Solar Cost
8.86 kWh	€1.96
Imported selected period	**Import Cost**
7.40 kWh	€1.64
Generated selected per...	**Generated Value**
1.455 kWh	€0.32
Exported selected period	
0 kWh	

Overview



August 2021
Home Assistant has joined the chat.

What is Home Assistant?

- Their website (https://www.home-assistant.io/) states “Open source home automation that puts local control and privacy first.”
- Works on a raspberry pi, windows, mac and virtual machines.
- Loads of integrations (EG: it will find a chromecast on your network if you have one)
- Can connect into existing systems, such as apple homekit as a bridge.
- Home Assistant allows more tinkering as well as a huge community.
- There are alternatives such as hoobs, openHAB, Homebridge, as well as the known Amazon Alexa and Apple Homekit systems

What is Home Assistant?

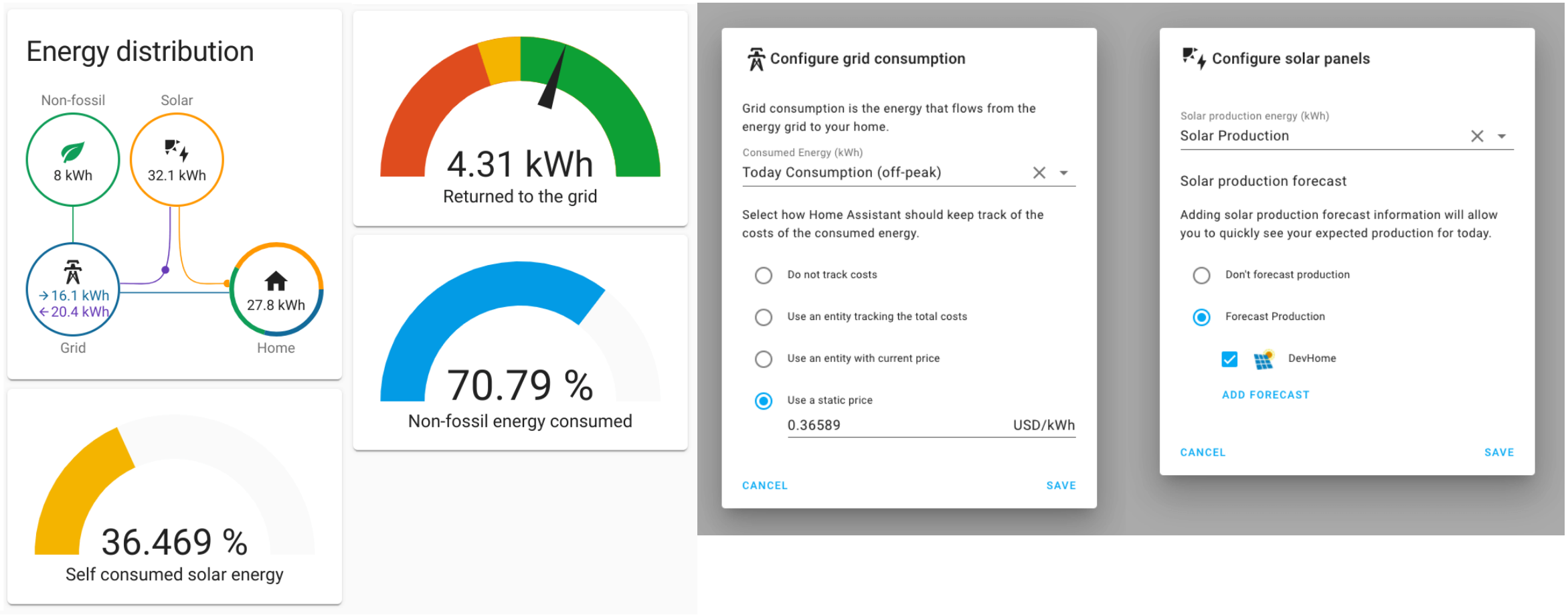
- Initially ran on a Pi4 with USB key
  - USB key died a few months later
  - Replaced with 300G USB SSD

- Later in 2022 ran as a VM on M1 mac-mini under TV. Needed scripting to boot VM again after mac power loss.
- Jan 2023 – Running on Intel N100 microPC running Proxmox VE
  - Backed up nightly with Proxmox backup server
  - HA config also encrypted and backed up to google drive with a plugin
- HACS – Home Assistant Community Store installed.

What is Home Assistant?

- Everything is a device
- Everything within that device is an entity.
- Common entities are sensors, binary_sensors, number, switch and button
- For example:
  - Hall light is a device
  - Hall light switch is an entity
  - Hall light brightness is an entity

Main motivating feature: Energy Monitoring



https://www.home-assistant.io/blog/2021/08/04/home-energy-management/

Energy Monitoring

- Needed to make sensors for each tariff
  - Named according to advertised name (Elec Ireland 2-4am nightboost)
    - Sidenote, this became an issue when I changed supplier
- Needed a way to update these sensors at tariff change.
- This was done by way of customised yaml and ‘utility_meter’ based entities.
  - This is easier now in current versions.

Energy Monitoring

Configure grid consumption

Grid consumption is the energy that flows from the energy grid to your home.

Pick a sensor which measures grid consumption in either of cal, Gcal, GJ, J, kcal, kJ, kWh, Mcal, MJ, MWh, Wh.

Consumed Energy
Peak

Select how Home Assistant should keep track of the costs of the consumed energy.

- ○ Do not track costs
- ○ Use an entity tracking the total costs
- ○ Use an entity with current price
- ◉ Use a static price

Price (EUR/kWh)
0.3386 EUR/kWh

Grid consumption

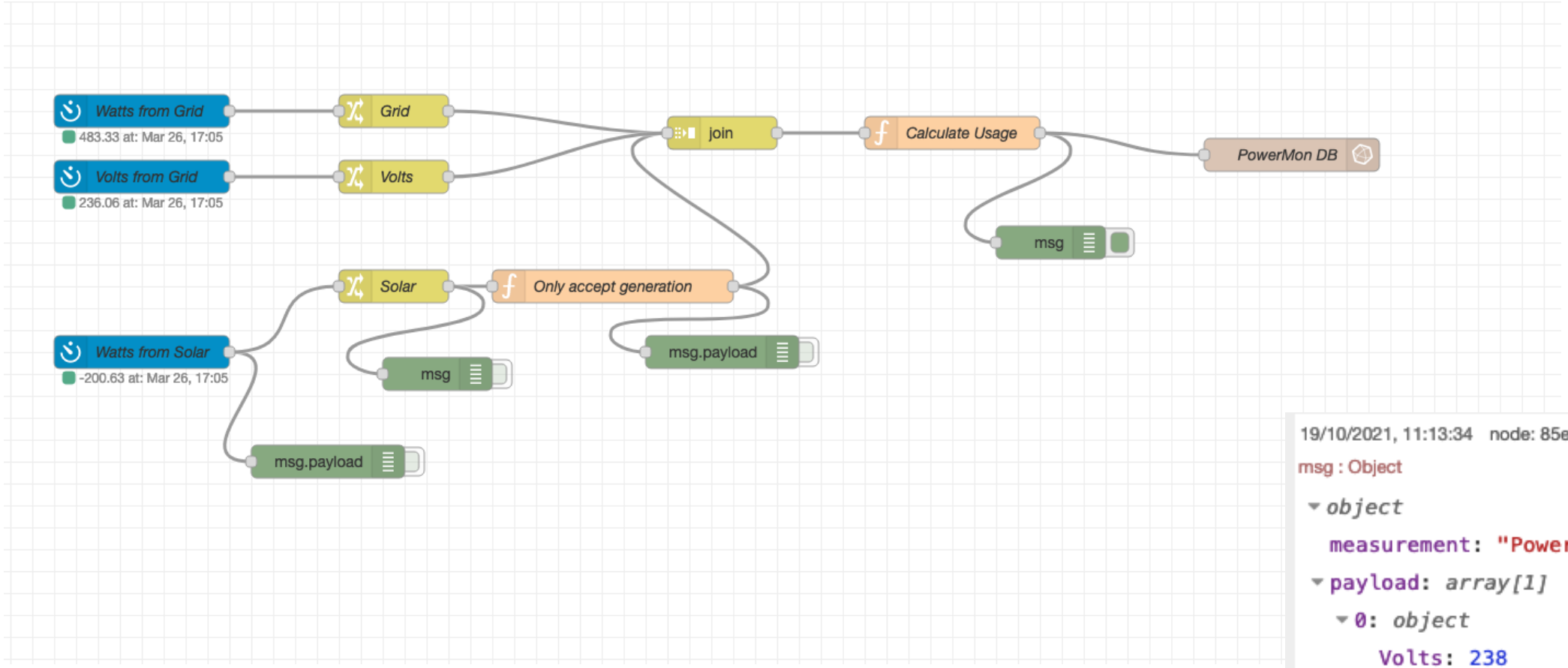
- Peak
- Mid Peak
- Off Peak

ADD CONSUMPTION

Energy Monitoring

	Peak	0.01 kWh	€0.00
	Mid Peak	0.92 kWh	€0.31
	Off Peak	8.7 kWh	€0.66

Moved energy monitor to Shelly EM



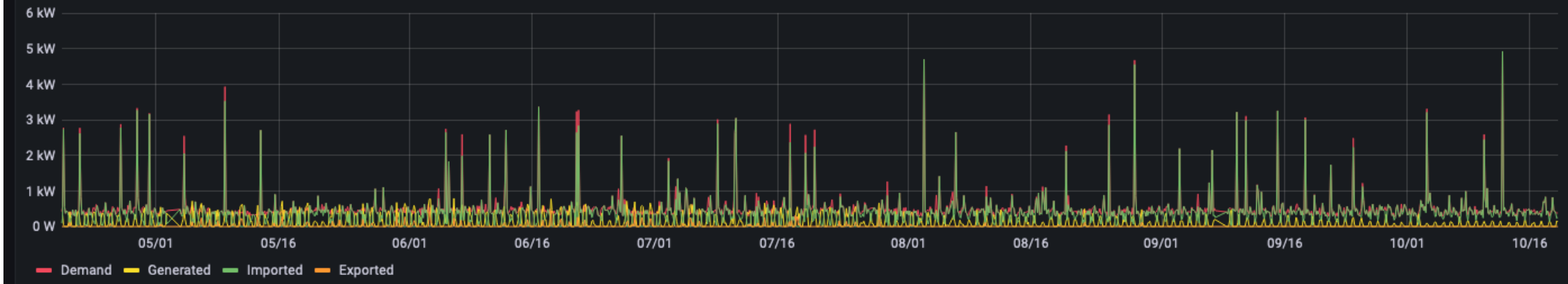
19/10/2021, 11:13:34 node: 85e439a0.e3ad4

msg : Object

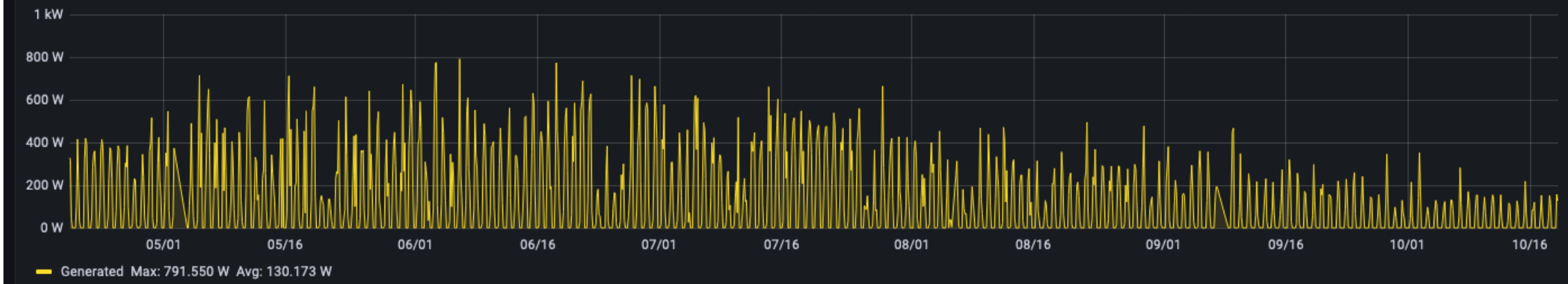

```
▾ object
  measurement: "PowerMon"
▾ payload: array[1]
  ▾ 0: object
      Volts: 238
      Demand: 415
      Exported: 0
      Imported: 256
      Generated: 159
  _msgid: "aca710efd394be59"
```


Still using node-red to keep my legacy dashboard alive

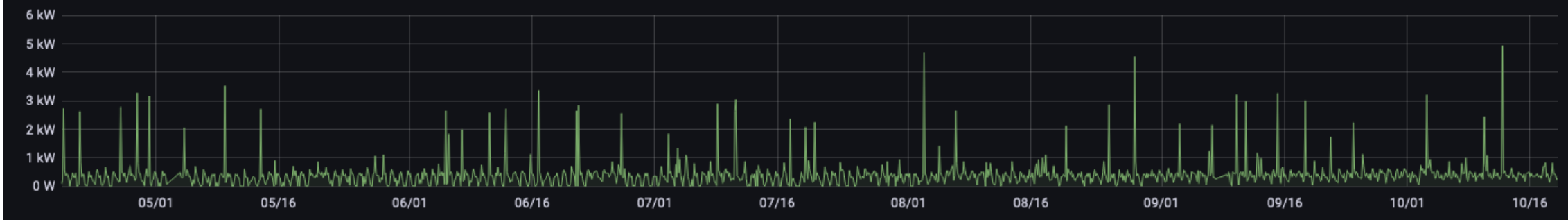
Overview



Solar Generated



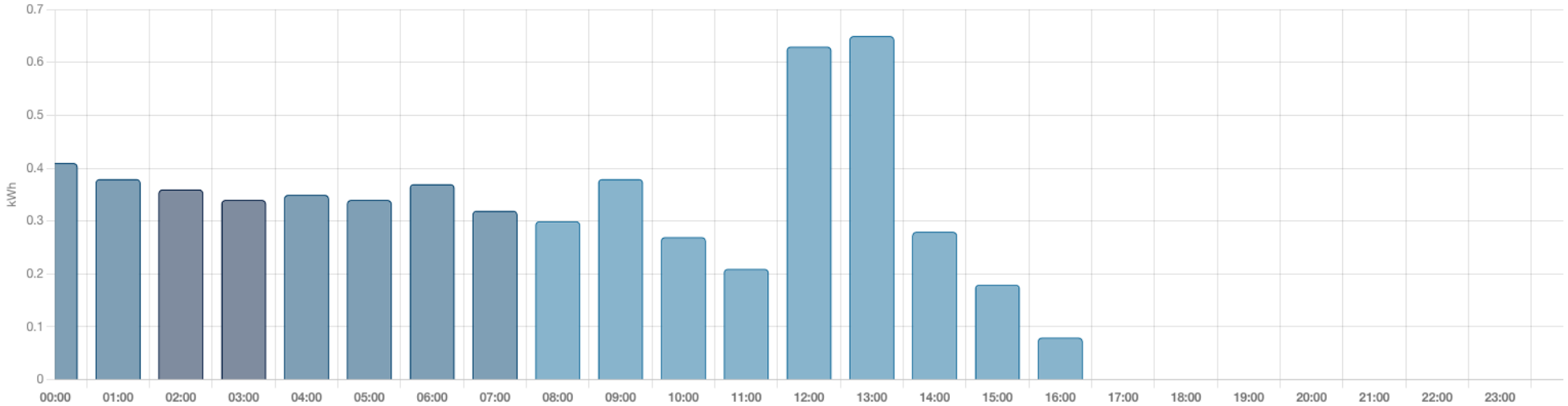
Grid Imported



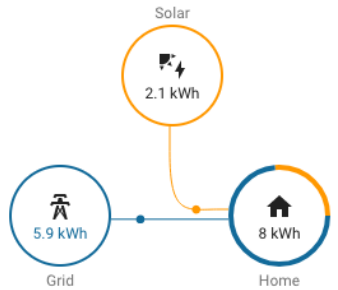
Energy

9 August 2021 TODAY

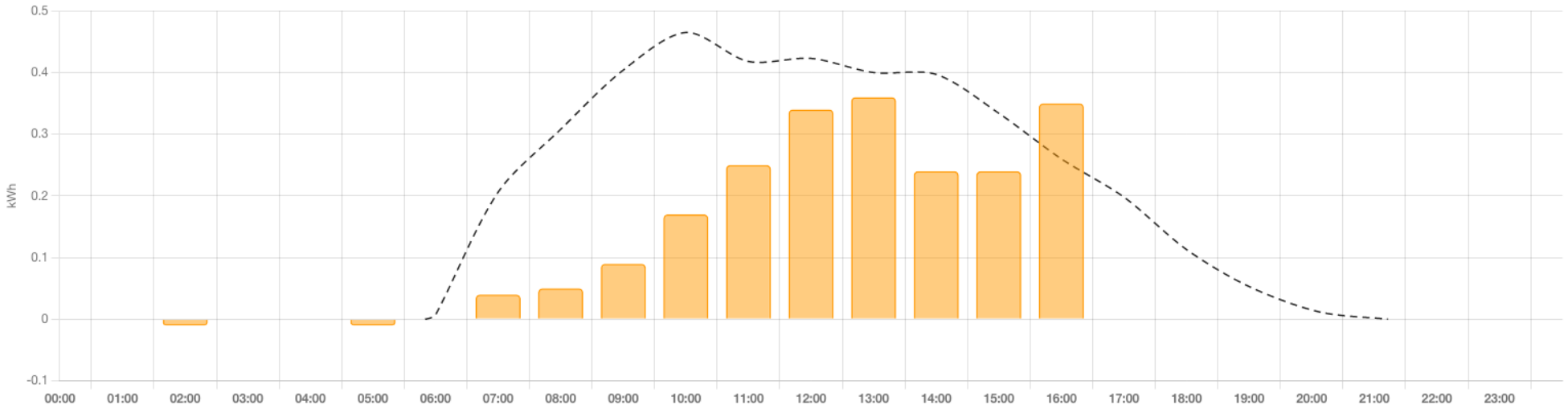
Energy usage



Energy distribution



Solar production



Let’s start digging

Managing our lights

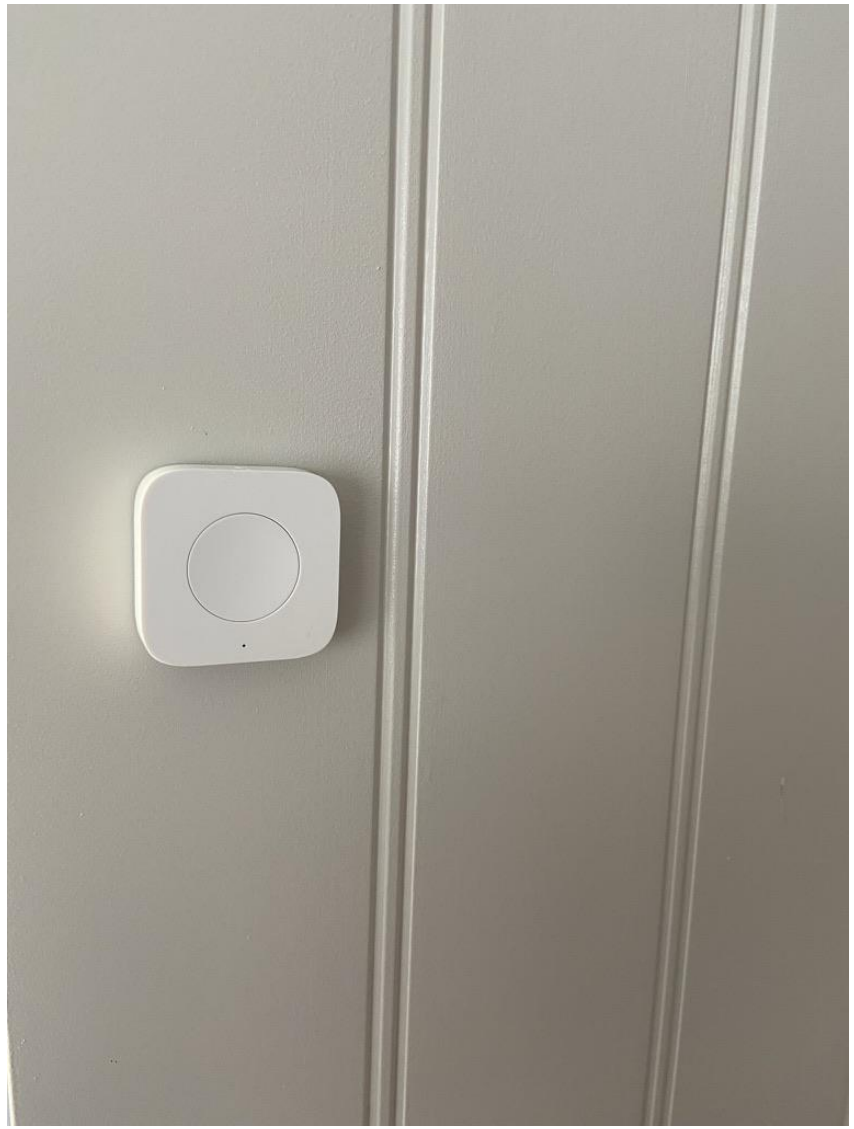
- First idea:
  - Automating porch light
  - Still be able to use standard wall switch

Danny McFadden reminded me that I had these shelly devices gathering dust

Managing our lights

- Second idea:
  - Home office room / non-agreed dumping zone.

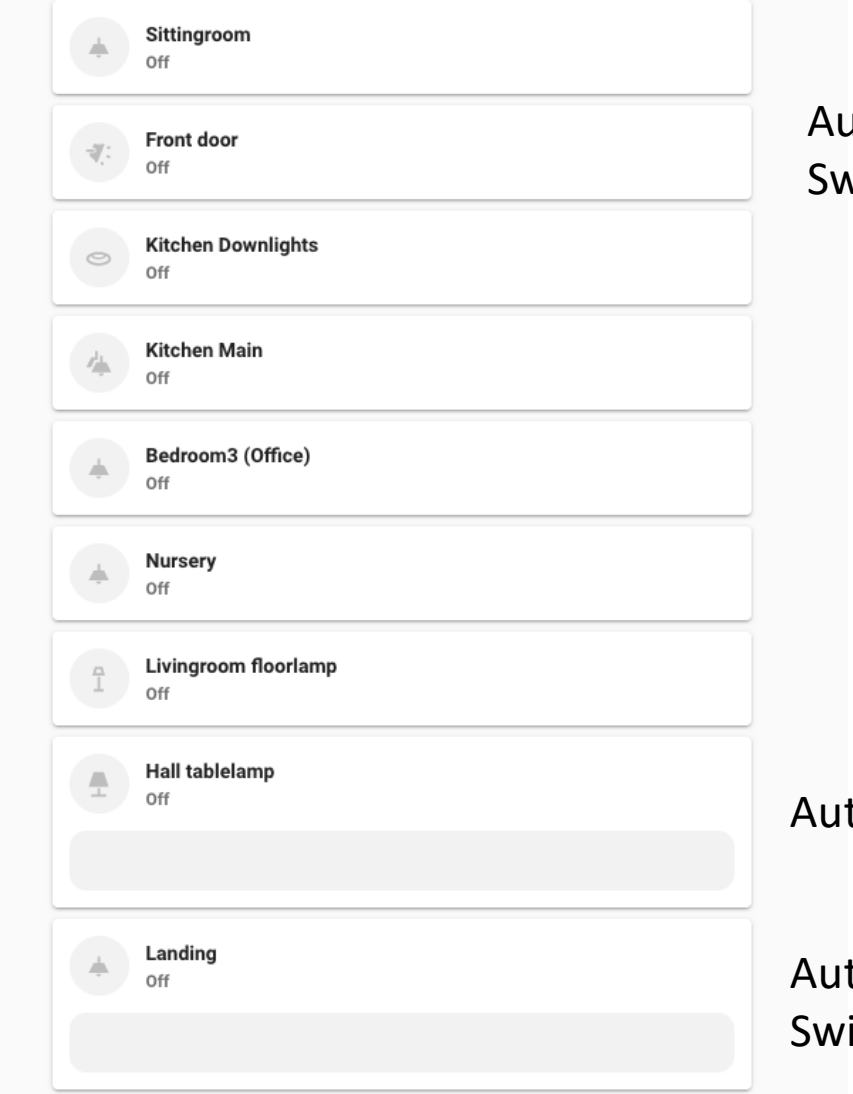
Managing our lights



- Third idea:
  - Existing inconvenient switch placement in kitchen for downlights
  - Sorted with a wireless button
  - Based on zigbee protocol
    - Already had zigbee dongle for this task
    - Uses same 2.4Ghz range. No issues so far
  - Toggles on/off downlights

https://www.aqara.com/eu/product/wireless-mini-switch/

Managing our lights



Automated to switch on after sunset = 50% brightness. Then 30% after 22:00
Switches off 20 mins after sunrise

Automated to switch on 45 mins after sun set if nobody is at home.

Automated to come on after sun goes down set light to 30%. Nightlight 1% at 22:30
Switch back to dimmed at sunrise. Then off at 20 mins later.

Managing our lights

IKEA *TRÅDFRI downlights*

IKEA lights use zigbee protocol

IKEA *TRÅDFRI lightstrip*

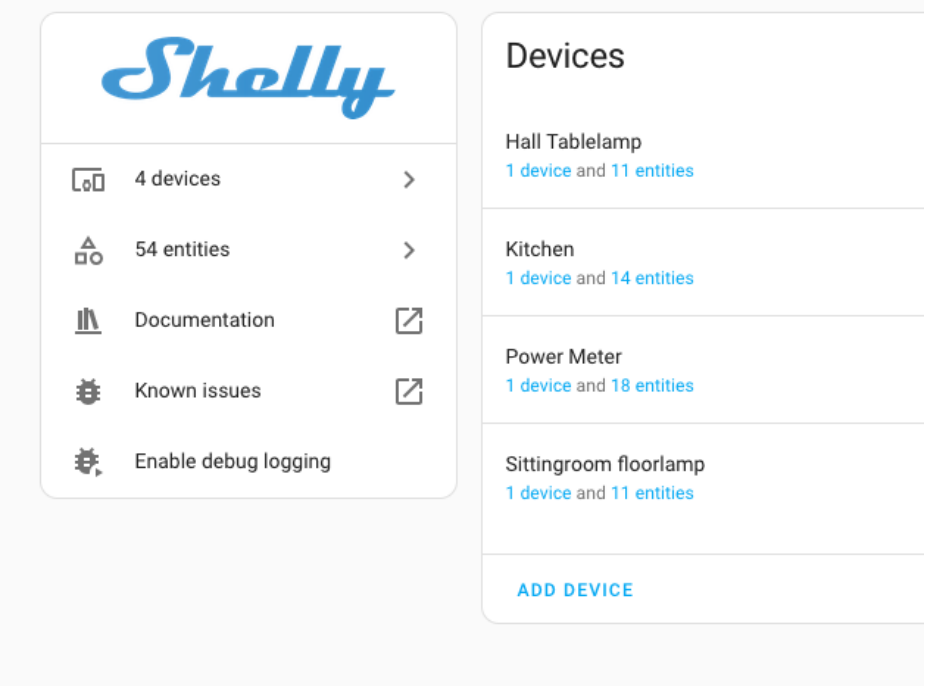
Managing our lights

Single click: My side
Double click: Partners side
Hold: Full brightness

IKEA bulb

Managing our lights

- Later re-flashed each shelly 1 with ESPHome
  - This allows for more configuration using yaml
  - New Gen3 versions are more difficult, so I don't mind using the shelly HA integration. It's local anyway
  - Still can use detached switch mode
  - Example:
    - Sittingroom lightswitch toggles floorlamp rather than main light.

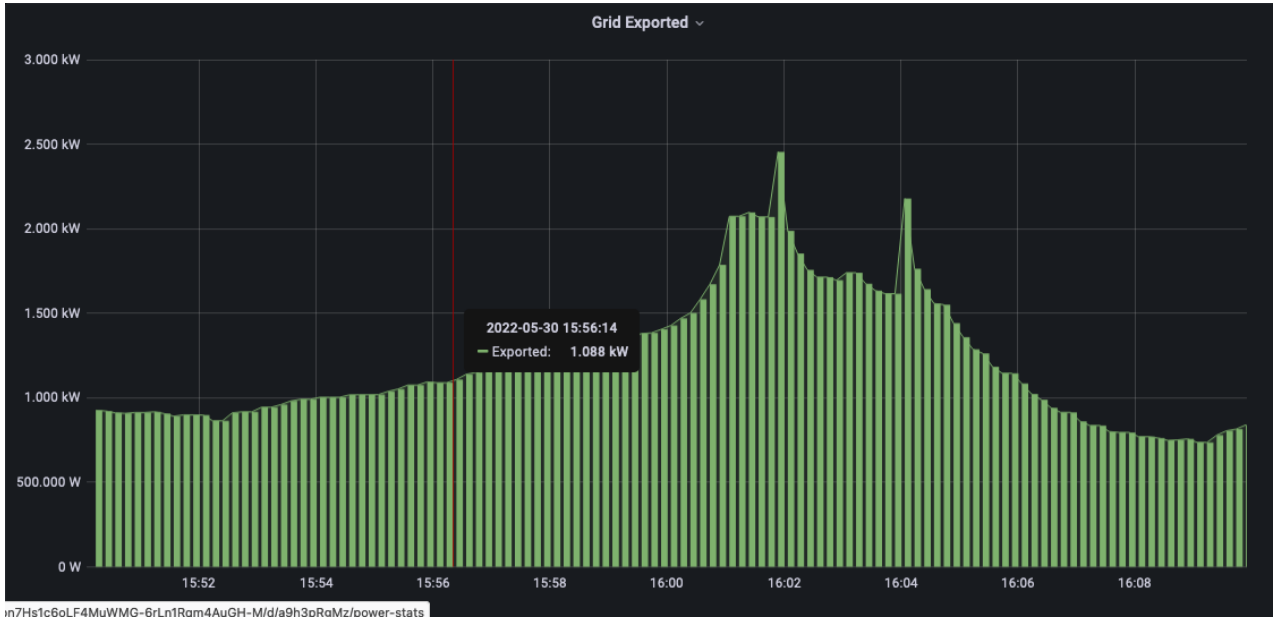


April 2022 – New Solar installation

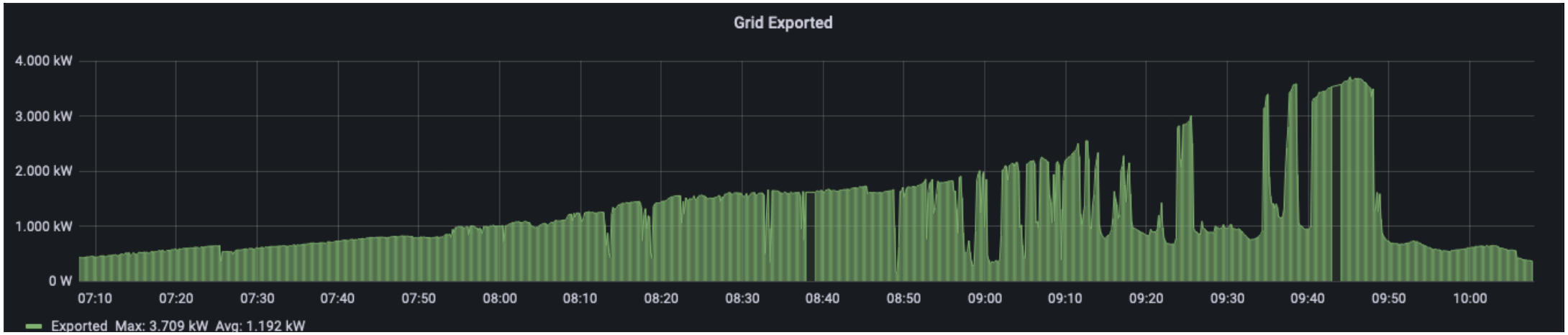
- 10 x 390W panels south facing.
- New 5kW Solis Hybrid Inverter
- 7kW of batteries added later

April 2022 – New Solar installation

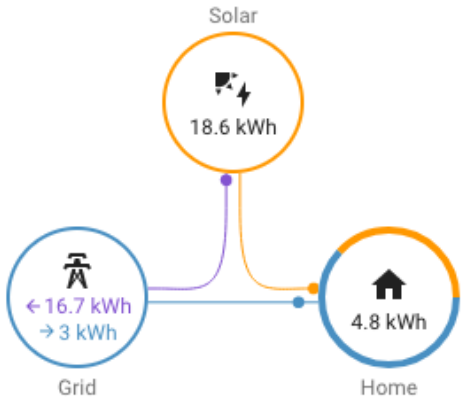
Soon after system powered on

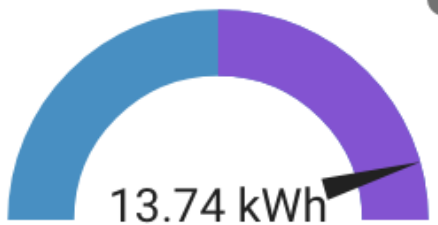


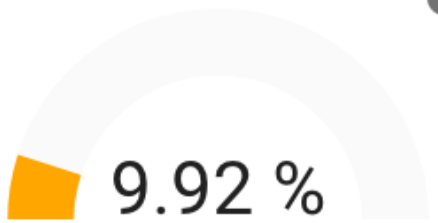
Following morning

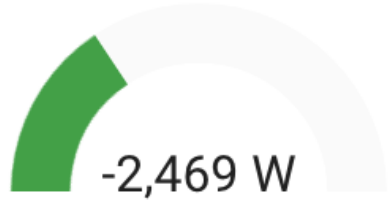


Energy distribution

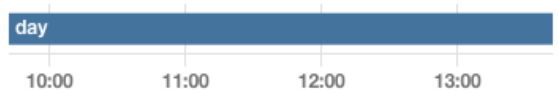




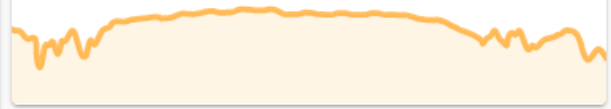




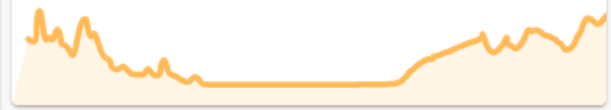
Active tariff



Grid Import / Export
-2,469 Watts



Rear PV
617 W



Front PV
2,348 W

Energy Costs

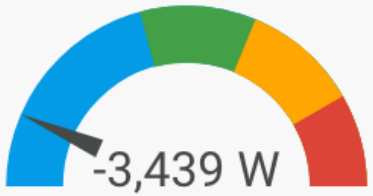
Daily Cost	0.25 €
Monthly Cost	1.03 €

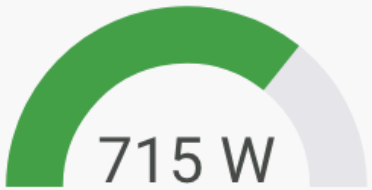
Energy Consumed - Daily

Grid - Day	0.06 kWh
Grid - Peak	0 kWh
Grid - Night	1.55 kWh

Energy Consumed - Monthly

Grid - Day Monthly	1.32 kWh
Grid - Peak Monthly	0 kWh
Grid - Night Monthly	4.79 kWh





Energy Generated

PV Front - Daily	2.7 kWh
PV Front - Monthly	91 kWh
PV Rear - Daily	0.84 kWh
PV Rear - Monthly	19.50 kWh

End of Day

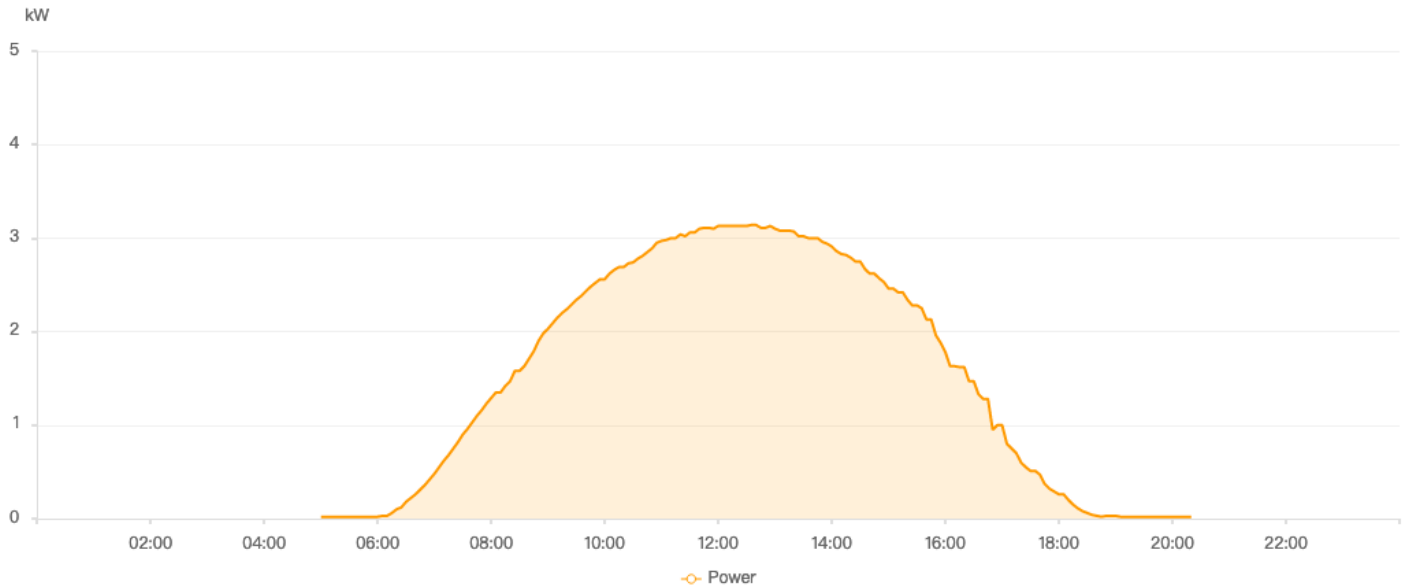
Energy Generated

PV Front - Daily	10.7 kWh
PV Front - Monthly	99 kWh
PV Rear - Daily	2.65 kWh
PV Rear - Monthly	21.31 kWh

Current Power	Daily Yield	Monthly Yield	Total Yield
0.02 kW	24 kWh	170 kWh	1.069 MWh

10/08/2022 | Day | Month | Year | Total | Export

Daily Yield : 24kWh Daily Earning : 5.28EUR Today Full Load Hours : 6.49h



Weather Today (Last Update: 10/08/2022 08:55:23 (UTC+00:00))

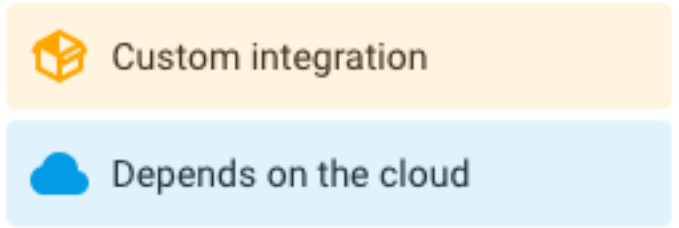
Weather Sunny/Clear	Sunrise & Su... 05:58~21:05	Wind Direction W
Temperature 14℃~26℃	Humidity 70%RH	Wind Speed 11km/h

Environmental Benefits

Equivalent Trees Planted 3.21	CO2 Emission Saved 271.077kg

Energy Monitoring

3.5.2



- Added SolisCloud integration to Home Assistant
  - Worked okay, but:
    - Updates only every 5 mins
    - Solis servers sometimes goes offline, or timeout
    - Graphs would not populate for a few hours.
    - Didn’t sit well that I had to keep polling a remote server in CN
    - Gen3 datastick did not allow local polling. Gen1 would not allow remote control

- Found a solution on github:

https://github.com/alienatedsec/solis-ha-modbus-cloud

Energy Monitoring

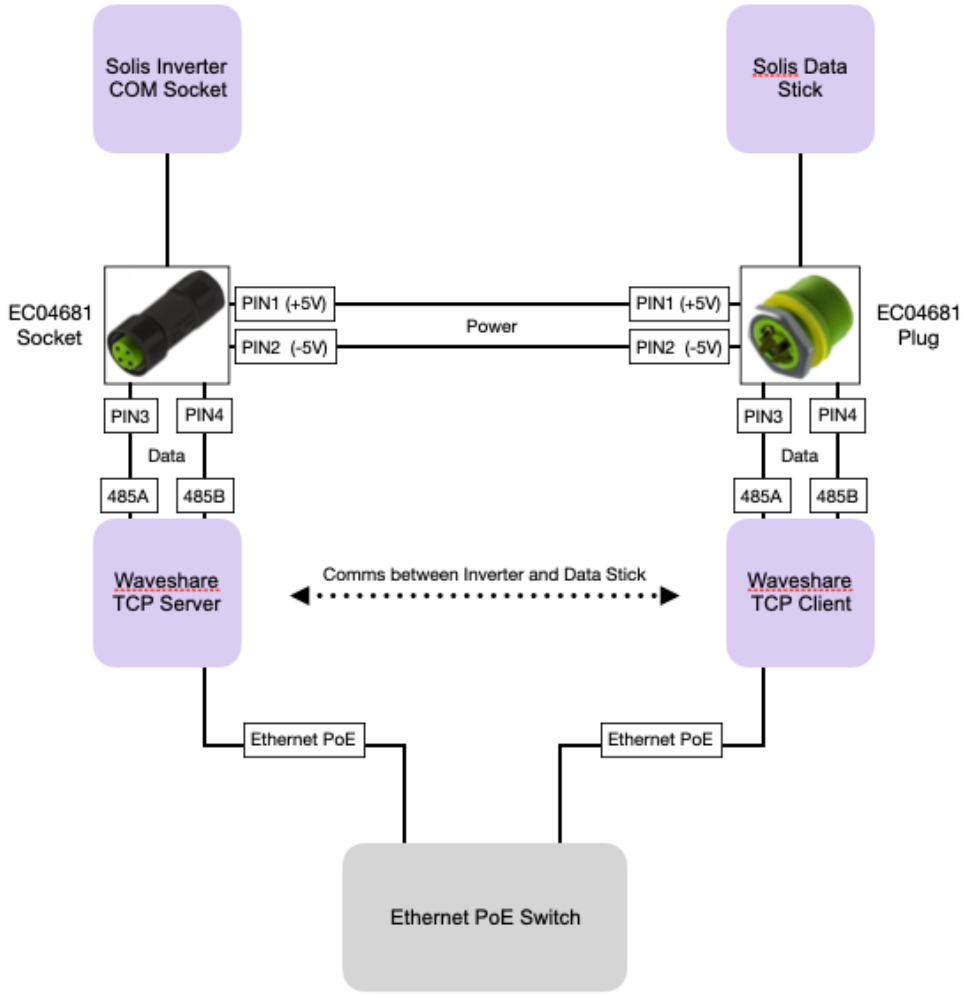


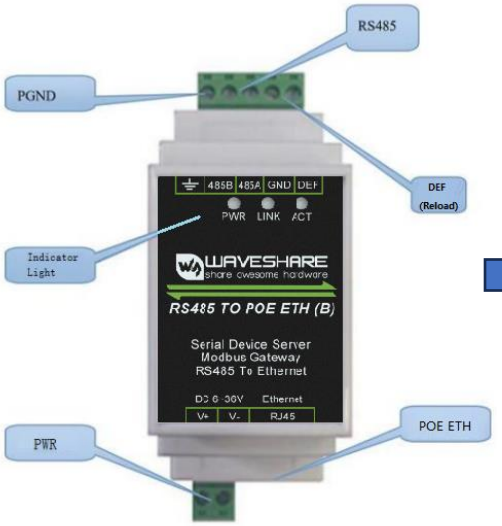
Diagram credit: Nick Hilliard

Energy Monitoring

- Each of the waveshare devices talk modbus RS485
  - One being a client
  - Other a server
- I can use a modbus integration with Home Assistant allowing local control and quicker usage reports
- I wanted to keep data in SolisCloud anyway as another source of nice graphs and data.

- Got rid of existing 1.5kW inverter and connected in rear array as string 2.

Energy Monitoring

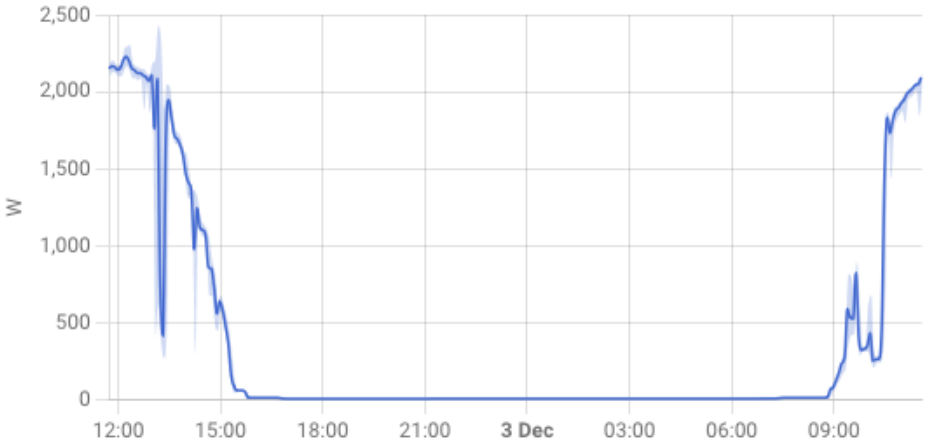


RS485 TO POE ETH(B)
PoE Ethernet port+ Electrical isolation

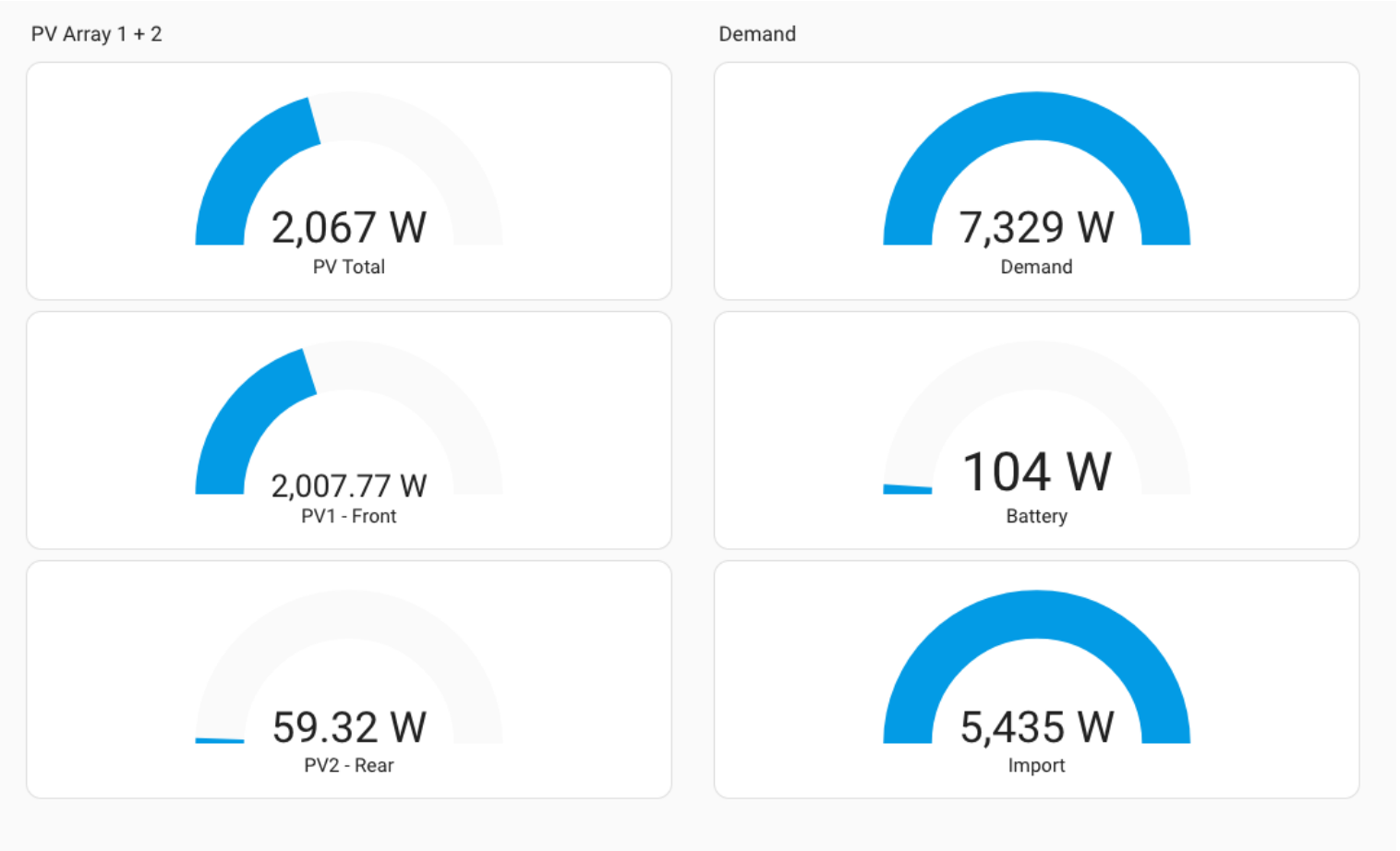
SOLAX POWER

2024.11.2

Custom integration



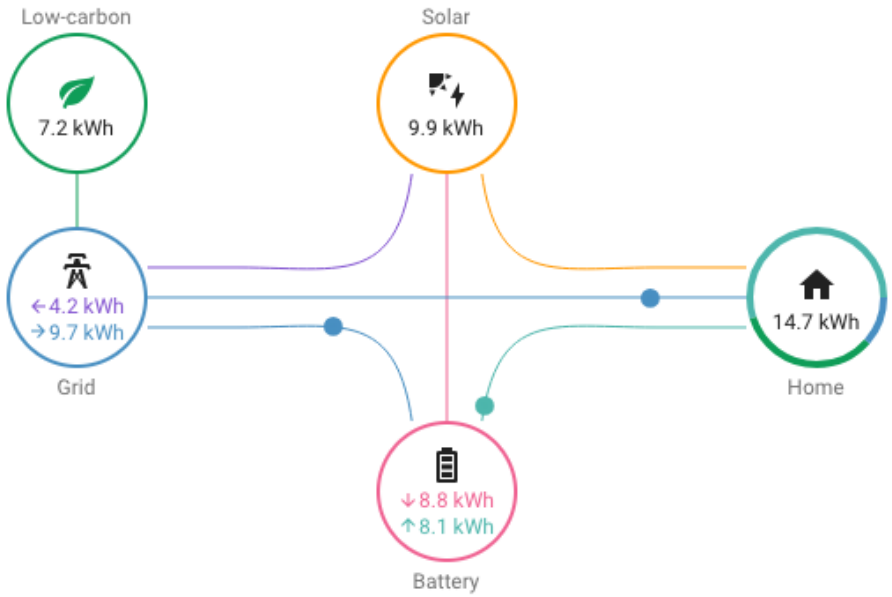
Energy Monitoring



Updates every 4 seconds
Snapshot 03/12/24

Energy Monitoring

Energy distribution



Sources

Source	Energy	Cost
Power Generation	9.9 kWh	
Solar total	**9.9 kWh**	
Battery Discharge	8.1 kWh	
Battery Charge	-8.8 kWh	
Battery total	**-0.7 kWh**	
Peak	0.05 kWh	€0.02
Mid Peak	0.92 kWh	€0.31
Off Peak	8.7 kWh	€0.66
Net Export	-4.15 kWh	-€1.00
Grid total	**5.52 kWh**	**-€0.01**

Snapshot of 02/12/24

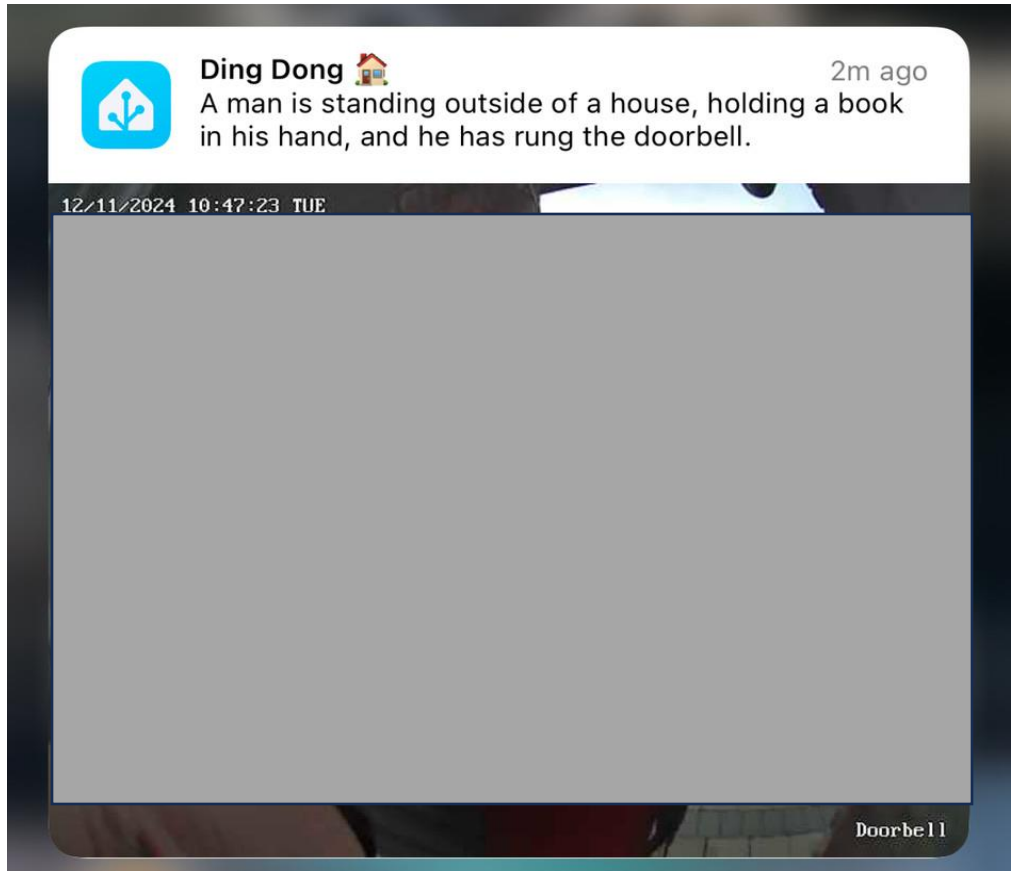
Home Assistant can do more for us

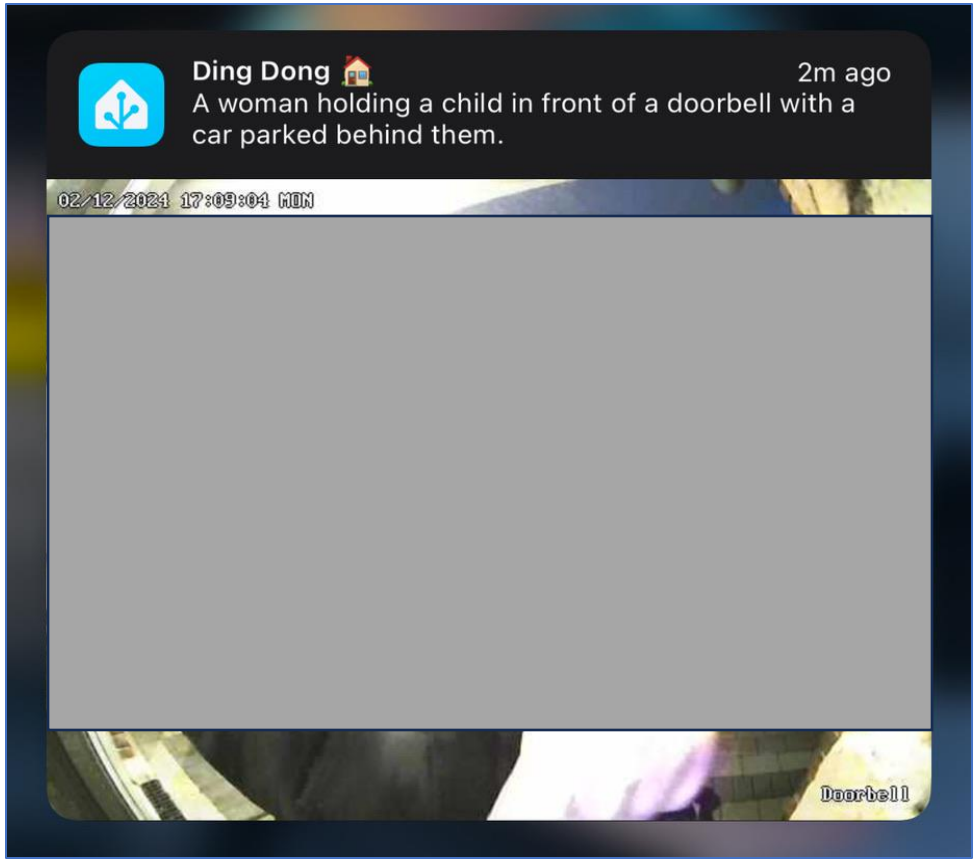
Need:
- Video doorbell that does not connect to cloud.
- Exception being Homekit secure video

Only for alerts

Home Assistant can do more for us

Need:
- Video doorbell that does not connect to cloud.
- Exception being Homekit secure video
- Tied into Ollama in order to use AI

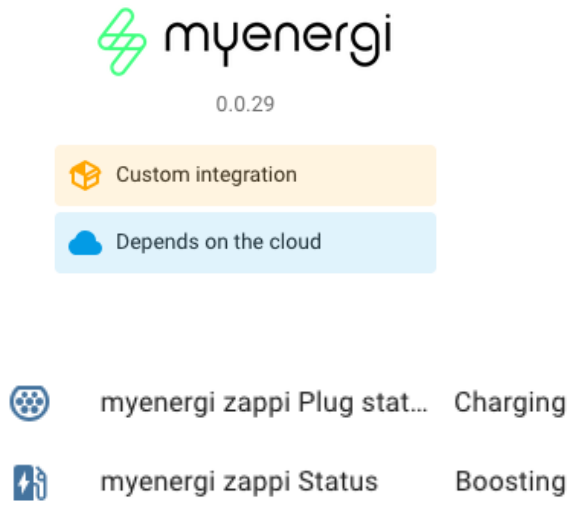


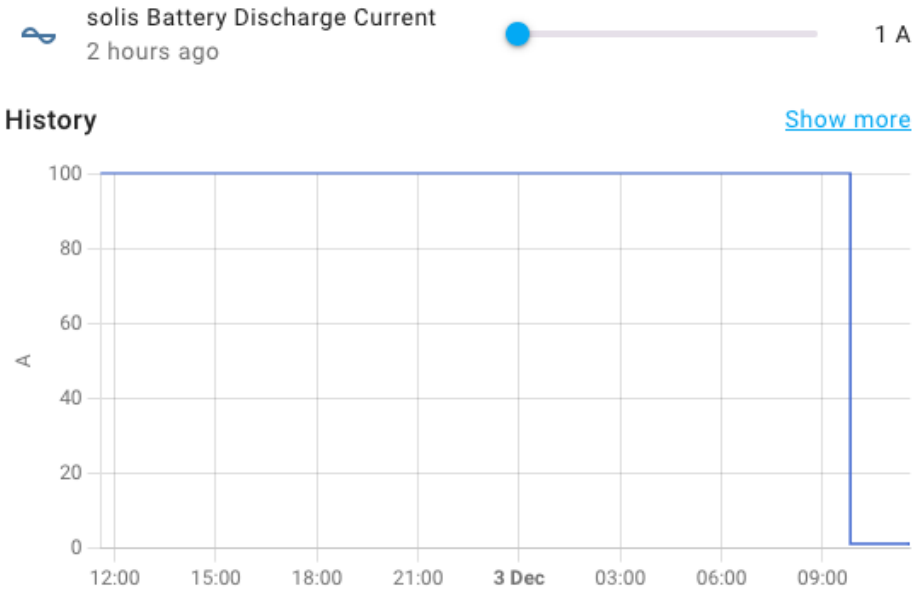


Home Assistant can do more for us

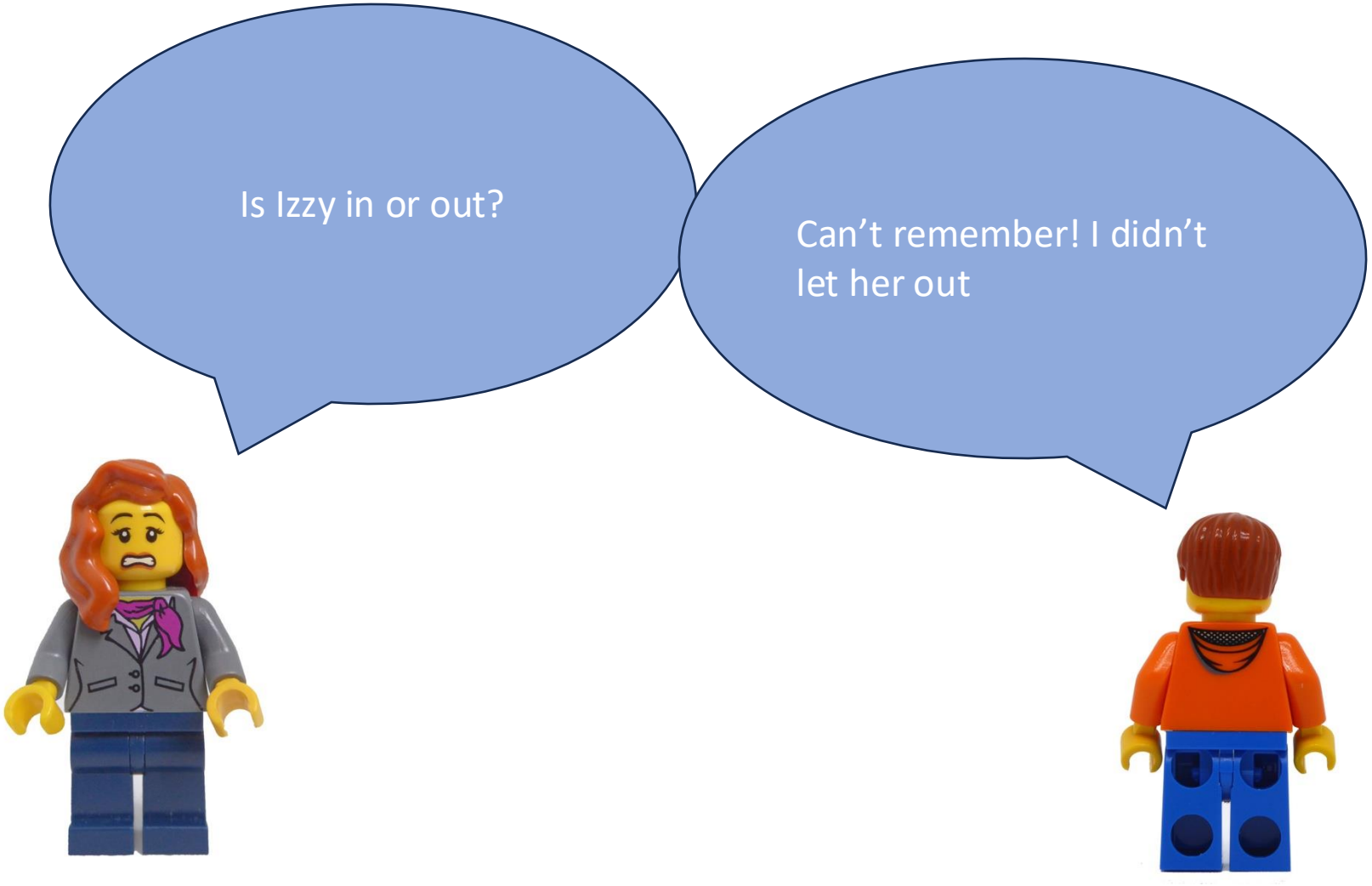
Need:
- Not drain home battery storage when car is charging during the day

Solution:
- Automation that watches for zappi charging and sets solis battery discharge to 1A (setting 0 would not work)



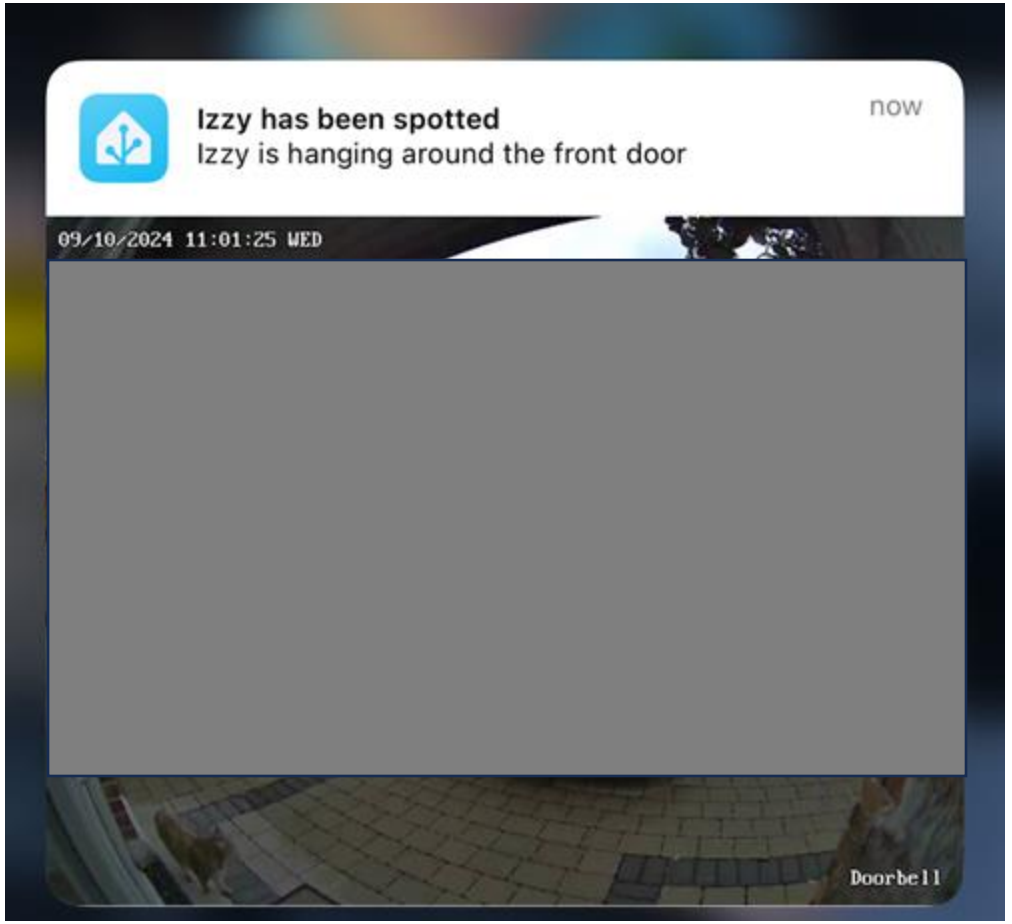


Home Assistant can do more for us



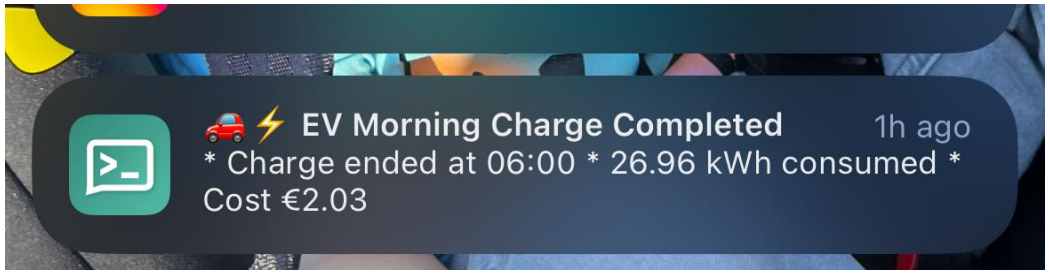
Home Assistant can do more for us

- Only 4 false alerts since configured in June 2024
- Frigate mask set around doorstep mat for a period of time – where she tends to sit and wait

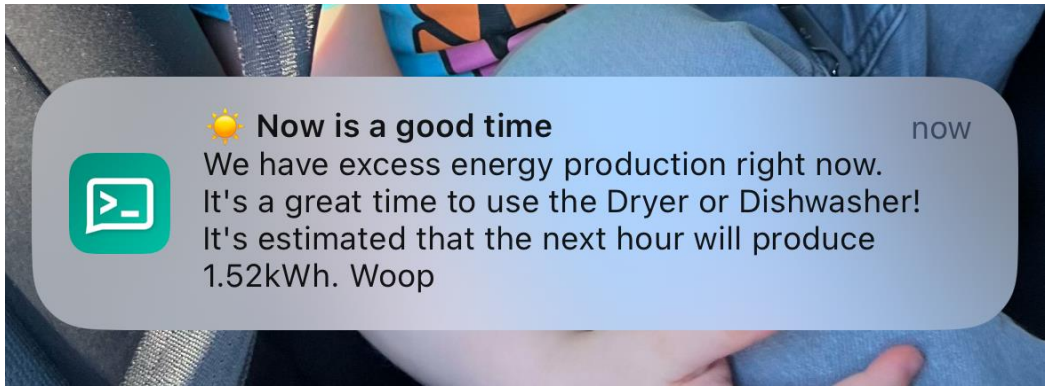


Home Assistant can do more for us

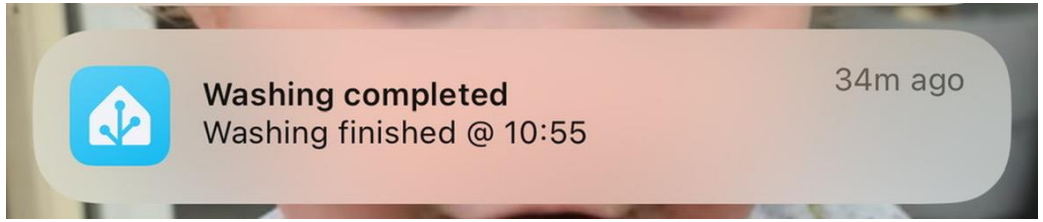
Some helpful notifications



Monitors Zappi – reporting usage and cost.
Helpful if there was an issue over night.



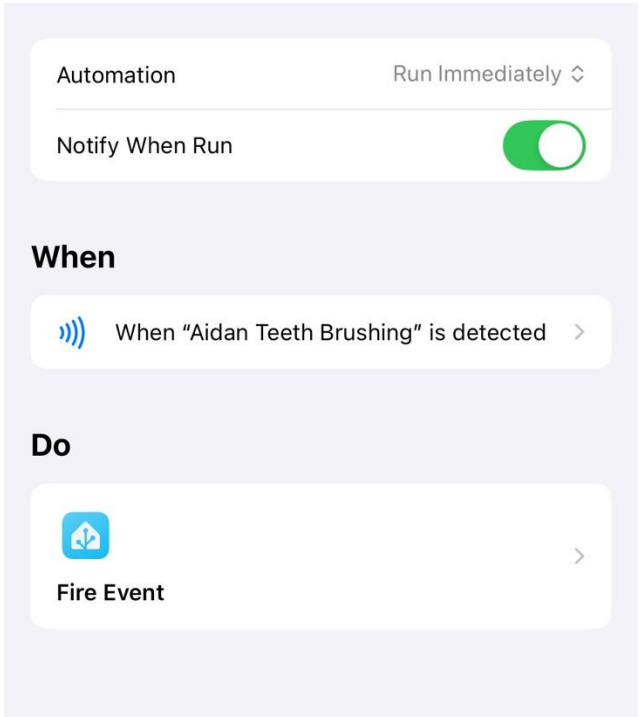
Copy of Electric Ireland’s sms alerts

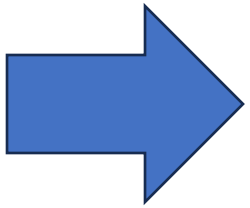


We always forgot to empty the washer into the dryer

Home Assistant can do more for us

- Using NFC tags:
  - Scan tag with iphone to play brushing teeth song for son





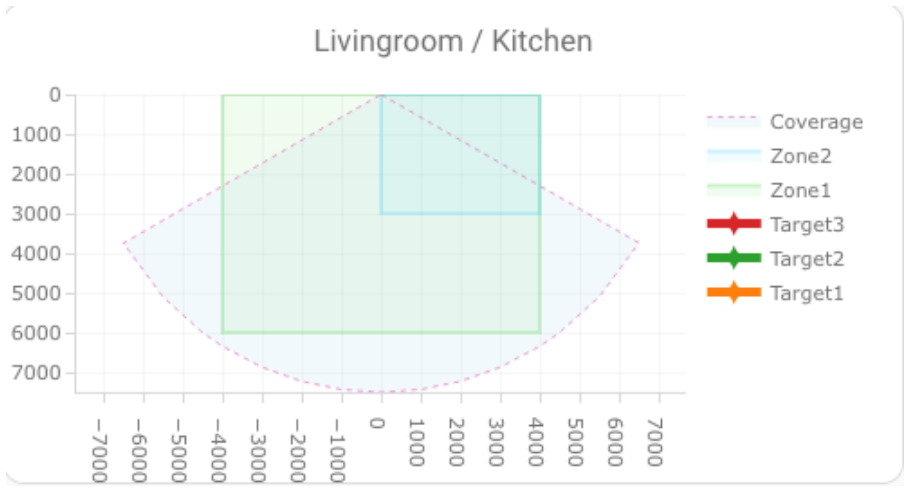
```yaml
sequence:
  - data:
      entity_id: media_player.sittingroom_tv
      command: system.launcher/launch
      payload:
        id: youtube.leanback.v4
        contentId: v=wCio_xVlgQ0
    action: webostv.command
  - wait_for_trigger: []
  - delay:
      hours: 0
      minutes: 0
      seconds: 15
      milliseconds: 0
    enabled: false
  - data:
      entity_id: media_player.sittingroom_tv
      button: ENTER
    action: webostv.button
```

DEMO:

- https://homeassistant.magpie-lizard.ts.net

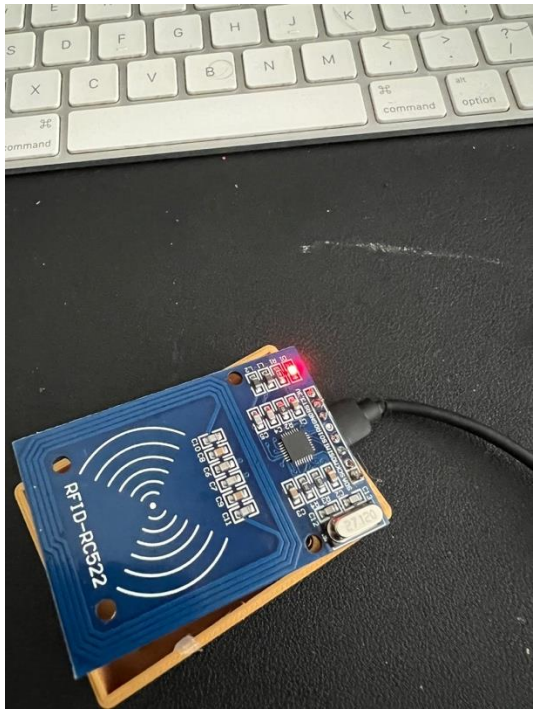
Future plans

- Look at adding more heating automation
  - Currently using climote API. Needs web access + delays in action
  - Needs yearly subscription for API to work.
- Testing esp32 (esphome) mmWave sensors
  - Currently enabled in the kitchen to switch on lightstrip under TV cabinets after 23:00



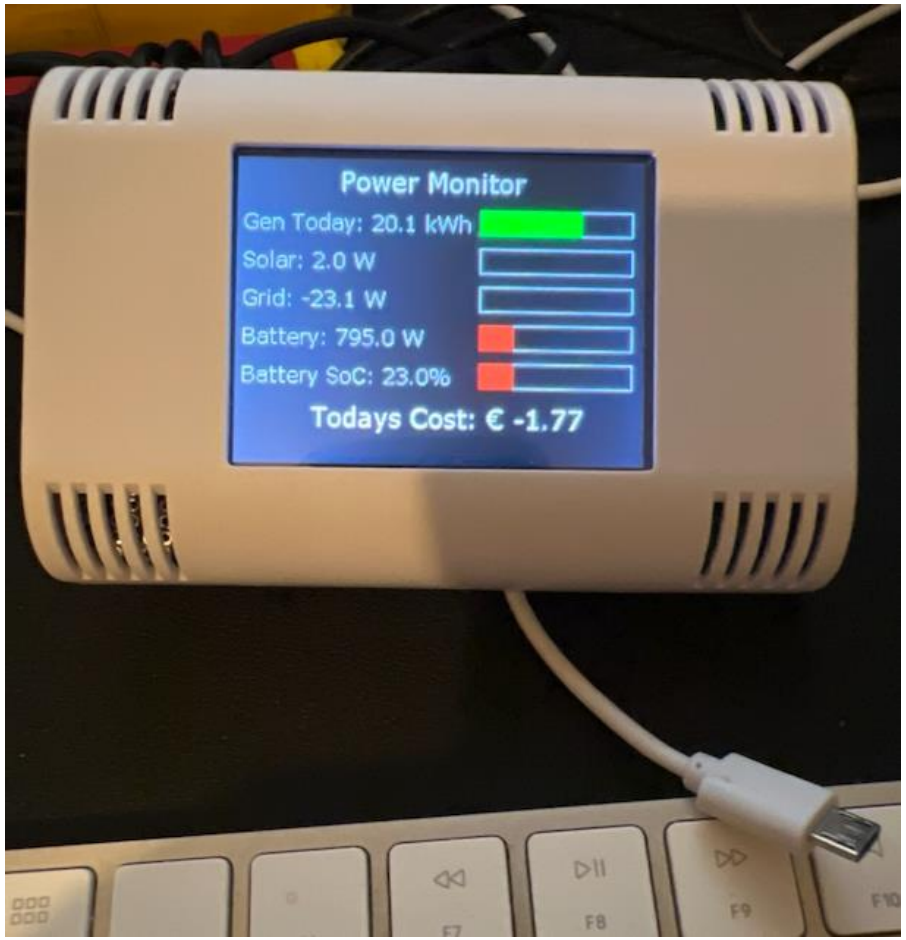
Future plans

- Learn more electronics
  - I’ve built some fun things leveraging ESPHome as the foundation
    - An RFID player for my son
    - Currently plays an education show he likes if a certain card is scanned
    - Actioned and controlled by Home Assistant



Future plans

- Learn more electronics
  - Built a power monitor display that uses esp32 and a small display

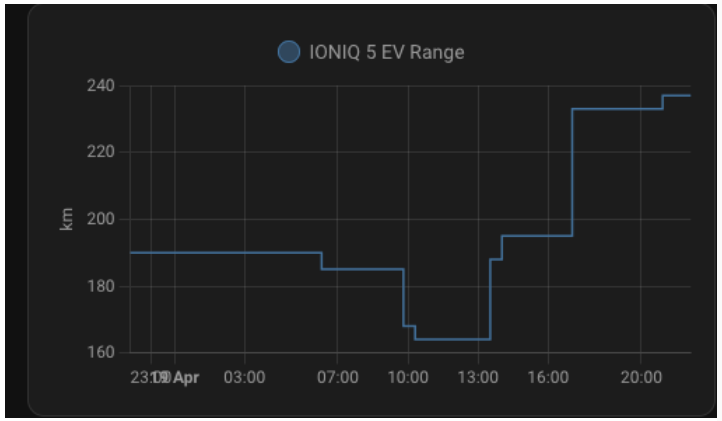


Lessons learned along the way

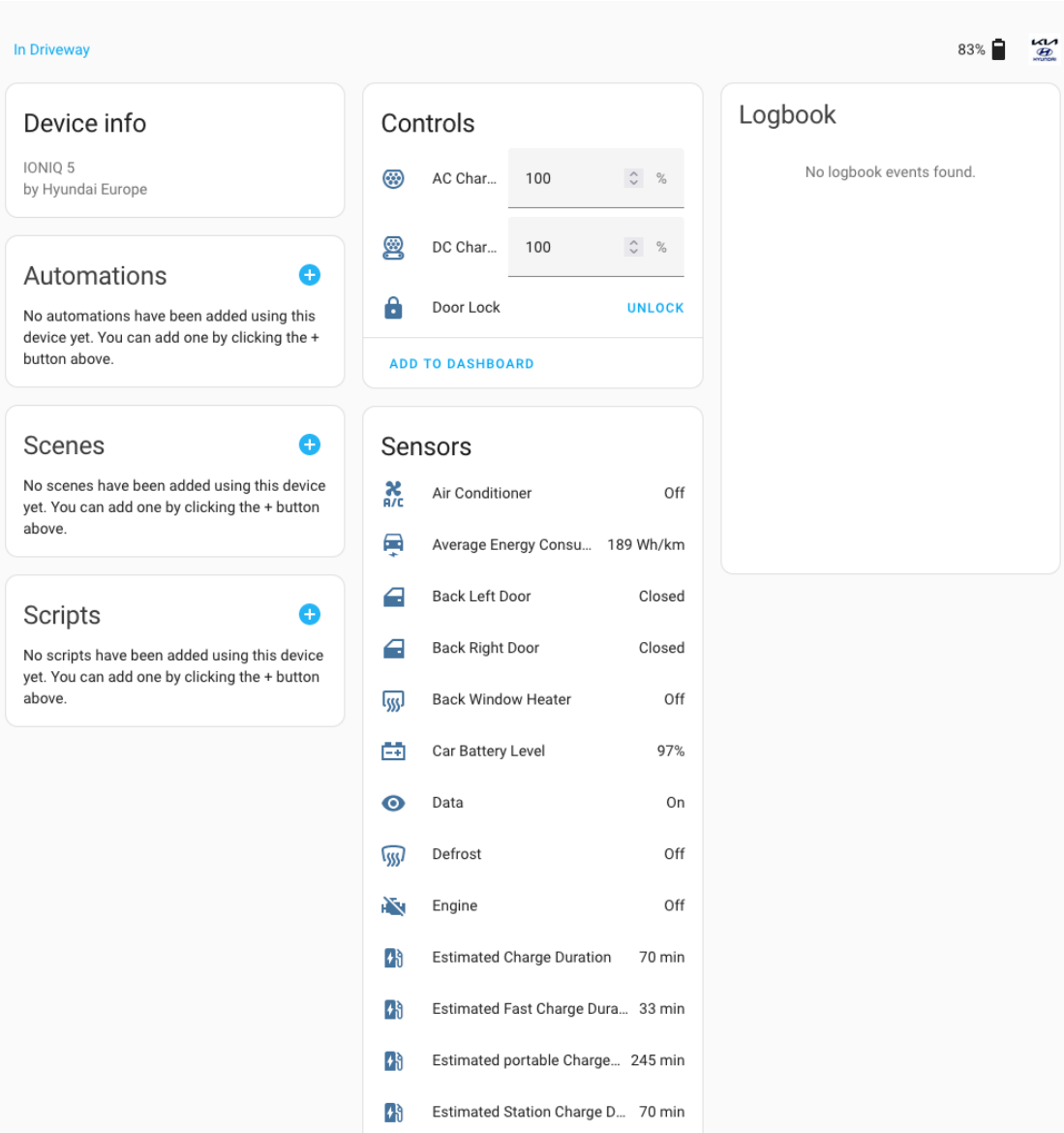
- Home Assistant is a rabbithole. Discipline is needed.
  - Jan 2024 with a new HA build – I started using it more as a solution for quality of life. More lights work without our interaction.
  - I do troll my wife from time to time though
- Name devices accordingly
  - Power tariff sensors is a prime example.
- You can turn anything smart with ESPHome
  - Using an ESP8622 or ESP32, you can come up with a solution to an issue.

Lessons learned along the way

- Just because you can add your car to home assistant, does not mean you should
- This polled Hyundai's servers every hour and led to an API rate limit for 24hrs
- It also caused the 12v battery to die
- Uninstalled never to be looked at again



But I do miss the range graph



Thank you